

ENVIRONMENTAL ASSESSMENT

EXPERIMENTAL MUSSEL RELOCATION

TENNESSEE RIVER MILE 194.0-195.0

HARDIN COUNTY, TENNESSEE

SEPTEMBER 2002

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Acronyms and Abbreviations

| | |
|-------|--|
| Corps | U.S. Army Corps of Engineers |
| EA | Environmental Assessment |
| EL | Elevation – feet above mean sea level |
| FWCA | Fish and Wildlife Coordination Act |
| FWS | U.S. Fish and Wildlife Service |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NPDES | National Pollutant Discharge Elimination System |
| NRHP | National Register of Historic Places |
| NWI | National Wetland Inventory |
| ppm | parts per million |
| TRM | Tennessee River Mile |
| SHPO | State Historic Preservation Office |
| TDEC | Tennessee Department of Environment and Conservation |
| TDNH | Tennessee Division of Natural Heritage |
| TRM | Tennessee River Mile |
| TWRA | Tennessee Wildlife Resources Agency |
| TVA | Tennessee Valley Authority |
| USGS | U.S. Geological Survey |
| WPC | Tennessee Division of Water Pollution Control |

1.0 INTRODUCTION

1.1 Background

The Tennessee River navigation channel, in the vicinity of Diamond Island, had been an area of recurrent sediment accumulation. A portion of the proposed site was last dredged to restore the required channel configuration in 1992. The navigation channel near Diamond Island had been previously dredged on six occasions dating back to 1953. In the past, dredged material was placed in the back chute of Diamond Island.

On January 25, 1999, Joint Public Notice was released by the US Army Corps of Engineers, the Tennessee Valley Authority (Cooperating Agency), and the State of Tennessee, which described proposed maintenance dredging work adjacent to Diamond Island. Coarse sand and gravel had accumulated at three small sites between approximate Tennessee River Miles (TRM) 196.2 and 196.7. The proposed placement sites were located in the back chute of Diamond Island, and at the toe of Diamond Island adjacent the right descending bank near TRM 195. The proposed dredging and placement sites may be located on a 1980 U.S. Geological Survey Pittsburgh Landing, TN 7.5 Minute Series Quadrangle. Approximate dredge site coordinates were listed as Latitude 35 deg., 10 min., 22 sec., Longitude 88 deg., 18 min., 37 sec.

Following release of the public notice, and in the course of preparing an EA for this proposal, it was determined that mussels had colonized past dredge spoil placement sites in the back chute. Also, unlike in the past, mussels had re-established themselves within the proposed dredge site. As a result of these findings, the Corps decided to delay dredging in order to develop a better understanding of the impacts of the proposal.

A 1999 mussel survey performed by TWRA, located a few listed species surrounding the Diamond Island area. *Cyprogenia stegaria*, *Lampsilis abrupta* and *Plethobasus cooperianus*, were found upstream and downstream of the proposed dredge site and in the back chute of Diamond Island. A 1999 survey conducted by the Tennessee Valley Authority within the proposed dredge site discovered that two of three specific areas that required maintenance dredging supported high-density mussel populations dominated by *Fusconaia ebena*, *Quadrula pustulosa*, *Obliquaria reflexa*, and *Ellipsaria lineolata*. No endangered species were found during the TVA survey. The two areas that support high-density mussel populations covered 4.3 acres (approximately 17,410 square meters). Based on an average density in these two areas (66.4 individuals/sq m) approximately 1.1 million mussels could be affected by proposed maintenance dredging activities. Relocating that number of mussels to minimize impacts to the resource would be extremely difficult and expensive if conventional methods were used.

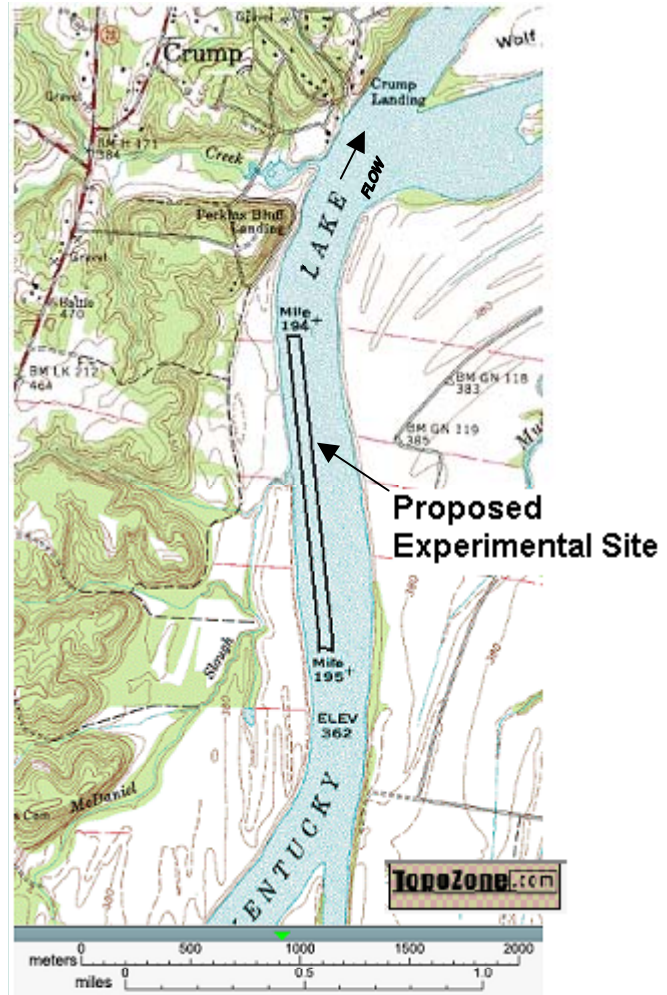
On April 29, 2002, an inter-agency meeting was conducted to discuss proposed maintenance dredging activities at Diamond Island. Topics included a history of events that occurred since the release of the Public Notice dated January 25, 1999, the mussel resources, and mussel relocation methods. Participants included representatives from the Tennessee Wildlife Resources Agency (TWRA), the U.S. Fish and Wildlife Service

A small section within the Diamond Island dredge site was proposed to implement the experimental mussel relocation method. However, given the sensitivity of the area, and due to the high number of mussels, a surrogate site was identified just downstream on the LDB between TRM 194.0-195.0. This river reach was currently permitted for commercial sand and gravel extraction and had been recently disturbed. Removal and relocation sites would be located within this reach in which the proposed mussel relocation method could be considered. The proposal: An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging, is found in Appendix A. Figures 1 and 2 display the vicinity and site maps of the surrogate site respectively.

A map of Tennessee showing the Tennessee River. The river is highlighted with a thick red line, flowing from the northwest towards the southeast. Major cities are marked with black dots and labeled: Nashville in the northeast, Memphis in the southwest, and Jackson in the center. Other cities shown include Knoxville, Chattanooga, and Louisville. The Tennessee River is labeled in large, spaced-out letters across the middle of the state. A yellow dot on the river is labeled 'Crump' with a callout box that says 'CRUMP, TN'. The map also shows various highways (interstates and state routes) and smaller towns.

Figure 2. Experimental Site Location just upstream Crump, TN, between Tennessee River Miles 195.0 and 194.0, on the Left Descending Bank. Water depth would be variable depending on pool height and scow displacement.

USGS Topographic 7.5-Minute Series Map: 13 NE
Pittsburg Landing, TENN, 1972



This Environmental Assessment (EA) has been prepared to address potential environmental effects of the proposed “experimental relocation” method and its implication for consideration as an alternative method to relocate mussels in applicable future proposed maintenance dredging activities. This EA contains information gathered during preparation of the original EA for proposed maintenance dredging in the navigation channel adjacent to Diamond Island. This EA also contains information describing the “experimental method” proposal, An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging, prepared by scientists at the U.S. Army Engineer Research and Development Center. The No Action Alternative is also considered. This EA is prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality’s (CEQ) regulations published at 40 CFR Part 1500, and Engineer Regulation 200-2-2 *Procedures for Implementing NEPA*.

1.2 Authority

The “experimental mussel relocation” method would be utilized where appropriate with routine maintenance dredging operations to reduce the effect maintenance dredging

activities have on the aquatic resources of a river system. The Rivers and Harbors Act of July 3, 1930, authorized the permanent improvement of the Tennessee River to a navigable depth of nine feet at low water from the mouth to Knoxville, Tennessee (46 Stat. L. 927-28). Section 4(j) of the Tennessee Valley Authority Act requires TVA to provide a nine-foot channel in the Tennessee River from Knoxville to its mouth. Since passage of the Tennessee Valley Authority Act of 1933 (48 Stat. L. 58-72), later amended on 31 August 1935 (49 Stat. L. 1075-81), Corps responsibilities have been in accordance with navigation laws. These laws place control and supervision of navigable water with the Secretary of the Army, Corps of Engineers, in addition to a Memorandum of Agreement between the Corps and TVA dated October 26, 1962. The Corps - Nashville District, has statutory responsibility to maintain an open and safe navigation channel along the 652 navigable miles of waterway on the Tennessee River. TVA also views the provision of an open channel, as carrying out part of TVA's statutory mission; therefore, TVA is a cooperating agency in this NEPA process. In addition, TVA has special expertise in mussel management. The "experimental relocation" method, if successful, could be used as a mitigation measure under NEPA, the Fish and Wildlife coordination Act, and a reasonable and prudent measure under the Endangered Species Act.

1.3 Purpose and Need for Action

The purpose of the experimental mussel relocation method is to safely remove mussels prior to maintenance dredging activities. The need to maintain an open navigation channel in the Tennessee River was presented in the November 1975 Environmental Impact Statement (EIS) that addressed the operation, maintenance, and management of water resources development projects from TRM 0.0 through 652.0. A final EIS covering the District's open-channel maintenance program was filed with the President's Council on Environmental Quality on March 7, 1976. The EIS identified 15 dredge sites, including Diamond Island that required maintenance at least once every three to eight years. These actions are generally described as routine channel maintenance actions. Routine maintenance dredging provides adequate depth and width along the Tennessee River to assure the continuation of safe and efficient water-based commerce in this portion of the nation's interior waterway system. Specifically, maintenance of a clear navigation channel is necessary for continued navigation access through Kentucky, Tennessee, and Alabama, and to the utility, industrial, and commercial facilities along the river within those states.

The purpose of the experimental mussel relocation method is to safely relocate large and unavoidable mussel communities prior to maintenance dredging activities. A safe, efficient, timely, and holistic mussel relocation method is needed because mussel communities are sometimes found at maintenance dredging sites where shoaling and natural sand and gravel deposition occurs. Maintenance dredging is required to maintain a safe and open authorized navigation channel.

The experimental mussel relocation method is proposed as a possible procedure to safely relocate mussel communities. If successful, this method could be used to protect large mussel communities by relocating as many as possible to selected placement areas.

Cultivating new beds would expand the commercial resource. Additionally, any listed species, especially juveniles that are missed during traditional hand removal and relocation by divers, would have a chance to grow within the relocated community. Doing the experiment as planned would kill, injure or dislodge some of the invertebrates at the experimental dredge site. However the long term benefits are expected to outweigh the short term, immediate, and highly localized impact resulting from the experimental method. It is expected that mussels and other shellfish with time, will re-colonize the dredge area.

There is no feasible alternative to working in the river. The proposed experimental mussel relocation method is designed to relocate significant mussel resources prior to planned maintenance dredging. A No Action would not have a less adverse impact on the aquatic system in the long term. As shoaling continues to lessen the width and depth of the navigation channel, barges eventually drag along the bottom, crushing the aquatic community. In the event of barge grounding, emergency measures to free barges could be more devastating to the aquatic community because emergency activities could be immediate and not as accurate or protective of the aquatic system as planned maintenance dredging operations.

The proposed experiment is designed to maximize safe mussel removal and to minimize death, injury, or stress associated with handling, transport time, and potential burial at pre-selected placement sites. It is anticipated that by moving communities and a portion of their current habitat to appropriate placement sites would result in establishing additional mussel beds.

1.4 Process

The Corps performs regular inspections and annual hydrographic and bathymetric surveys to determine the need for channel maintenance dredging. Areas where the natural sedimentation processes of the river have caused an accumulation of riverbed materials that would eventually obstruct navigation along the river are scheduled for dredging. Dredging is necessary when the elevation of the channel bottom is less than 11 feet deep at minimum pool elevation (9-foot draft plus 2-foot clearance). A proposed dredge site is located during field reconnaissance from channel surveys that portray the river bottom elevation (EL) in feet above mean sea level. It was determined in this way that gravel and coarse sand had accumulated adjacent and within the navigation channel at Diamond Island. Such accumulations within the authorized navigation channel represent hazards to recreational and commercial navigation interests using the Tennessee River.

A typical dredging operation for the Diamond Island project would consist of a 3 cubic yard clamshell dredge and a 300-cubic-yard split hull barge to transport the substrate. Dredged materials, consisting of gravel and sand, are routinely placed in open water at locations away from the channel. Split-hulled dump scows have been routinely used to place dredged material at selected open-water placement sites. If the disposal area was close, a scow could be filled and emptied approximately 10 times per day. At this rate approximately 3,000 cubic yards of material could be moved in a day.

It is usually assumed that mussels will all be killed during a routine dredging operation. Mortality could be caused by action of the clamshell, or by burial or desiccation while the material is being held or transported. In addition, mussels could be killed if the material is placed in an inappropriate area. However, scientists at the Engineer Research and Development Center (ERDC), were not aware of any studies that quantified mussel mortality associated with a routine dredging operation. It is important to note that there is anecdotal information about survival as well as mortality. For example, in 1999 a dredge operator in the Corps - Huntington District, reported collecting large, live mussels exiting a pipeline from a hydraulic dredge being used in the Muskingum River. Corps personnel from ERDC examined the area later and found many living adult mussels in the disposal area, which were likely, those individuals that had been dredged from a maintenance site.

The experimental mussel relocation method proposes to use modified dredging operations and dredging equipment to relocate mussels. This process would involve the use of a clamshell dredge to remove the top 1-foot layer of the river substrate that normally contains the majority of the mussel community of all size classes. The material would be placed in a single layer within a split hulled dump scow containing water. The scow would be moved to a proposed placement site. The bottom of the dump scow would be opened slowly to allow the material to spread on the river bottom in a layer of approximately ½ foot deep. This technique would prevent deep burial of the mussels and would allow them to migrate to the substrate surface. It is anticipated that large gravel and large mussels would settle first followed by the lighter coarse sand and young mussels. In this way, the majority of the mussels, and their sand and gravel habitat, would be relocated without excessive handling or deep burial.

1.5 Experimental Site Location

During the April 29, 2002 meeting, the Corps proposed implementing the experimental mussel relocation method within a small select portion of the proposed Diamond Island maintenance dredge site. An area of less than ½ acre, containing a moderate density of mussels, was proposed. However, given the sensitivity of the Diamond Island area, both as a commercial musseling location, and the existence of listed species surrounding the proposed maintenance dredging site, this proposal was not considered favorable; therefore a surrogate site was proposed as the experimental site. An experimental site was located approximately 2 miles downstream from the proposed maintenance dredging site, between TRM 195-194 on the left descending bank. This area is currently permitted for commercial sand and gravel dredging. Through the permitting process, coordination and consultation had already been fulfilled with the USFWS pending any new information that could affect the consultation process. The TWRA offered to conduct site surveys and locate appropriate removal and relocation sites for the experimental relocation method within this river reach. This agency was familiar with the area and could collect this field information, and perform a site evaluation within a short period of time.

1.6 Experimental Site Setting

Environmental conditions at the experimental site are essentially the same as those at the proposed Diamond Island maintenance dredging site minus the dense mussel populations.

The surrogate site is also located in the tailwater of Pickwick Dam (TRM 206.5).

Although this stretch of the Tennessee River is within the Kentucky Lake pool, conditions are heavily influenced by releases from Pickwick Dam, and are more characteristic of a large river than an impoundment. The surrounding countryside is primarily agricultural with large patches of wooded areas. The riverbanks are fairly steep, benching up to a wide bottomland crossed by a number of creeks and sloughs.

On May 22, 2002, TWRA surveyed the permitted commercial sand and gravel river reach on the left descending bank, between TRM 194-195. The purpose of this survey was to evaluate the mussel resources, characterize the river substrate, and locate surrogate mussel removal and relocation sites. The topography of the river bottom within the experimental area varied from slightly sloping to irregular grooves. The last time commercial dredging occurred was in 2001 during exploration dredging when the quality of the river substrate was evaluated for commercial use.

A proposed removal area was located off shore near TRM 194.8. The river bottom gently sloped resulting in a water depth of about 20 ft. deep near shore to 25 deep near mid-river.

The substrate was composed of gravel and sand. Ten mussel species were found during a timed search at a collection rate of 10 mussels per minute.

A proposed relocation site was located off shore near TRM 194.6. The river bottom resembled a shallow bowl. Water depth varied from about 20 ft. deep near shore to 30 ft deep, then 25 ft deep near mid-river. The substrate was composed of sand and silt near the bank, and predominantly gravel toward mid-river. Twelve mussel species were found during a timed search at a collection rate of 4 mussels per minute. One federally listed species; a Pink mucket (*Lampsilis abrupta*) was found and relocated during the survey.

2.0 PROPOSED ACTION INCLUDING ALTERNATIVE

2.1 Proposed Action – Experimental Dredging

Prior to any action, divers would perform a preliminary evaluation of the selected removal and relocation sites as a follow-up to TWRA's survey. Divers would use timed searches to collect quantitative and qualitative mussel samples within the selected removal and relocation sites. All live mussels would be counted and identified. Quantitative substratum samples would also be collected from both sites to provide estimates of mussel densities and recent recruitment. Resident mussels collected from the selected relocation site would be moved to a new location. These mussels would also be used in a mark and recapture study (Miller and Payne, 1993) to evaluate long-term survival. Removing these resident mussels would minimize interference with survival evaluations of mussels from the removal site that are placed in the relocation site.

The Corps - Nashville District fleet, would perform the experimental relocation. A clamshell dredge and split-hulled scow would be used in the experiment. Two treatments are proposed. Treatment 1 would use a modified dredging technique. The clamshell bucket would be placed over the river substrate to an approximate depth of one foot. The bucket would close and the material would be brought to the surface and placed in a single layer within a split-hulled dump scow containing water. The material would be moved to the placement site. The bottom of the split-hulled dump scow would be opened slowly and while moving, spread the material in a thin layer of approximately ½ foot.

Treatment 2 would use regular dredging protocol. River substrate would be dredged without modification and up to a depth of 3-4 feet. The split-hulled dump scow would be filled to capacity and moved to the placement site. However, like Treatment 1, the bottom of the split-hulled dump scow would be opened slowly and while moving, spread the material in a thin layer of approximately ½ foot.

Both Treatment 1 and 2 would be evaluated for mussel damage and survival during specific phases in the dredging operation and at predetermined time intervals from removal to relocation.

2.2 Alternative - No Action

The ‘No Action’ alternative would involve no federal action at this time. The No Action alternative would consist of not conducting the experimental mussel relocation method as proposed. Current methods of mussel relocation would remain limited, especially for removing large numbers of mussels.

Current mussel relocation methods include hand removal by divers or the use of a diver operated suction dredge to move material to the surface where mussels are sorted out from the river substrate. These current methods entail handling mussels individually and several times, and are capable of collecting primarily only large mussels. Several years of size classes are lost because of the inability to see them or not enough time to collect them. A portion of mussels removed by any method will incur some damage, injury, or death. For individuals, survival is expected to be best when individuals are minimally handled. For a population, greatest well-being can be expected when all size classes are represented in that population. The proposed “experimental relocation” method would minimize handling of individual mussels and may have the best potential in preserving several mussel size classes that may be located within the top 1 foot of the river substrate.

3.0 AFFECTED ENVIRONMENT

3.1 Water Quality

The Rules of the Tennessee Department of Environment and Conservation, Division of Water Pollution Control Amendments, Chapter 1200-4-4, Use Classifications for Surface Waters, lists the Tennessee River reach between TRM 49.1-215.1, as fully supporting all its designated uses. These designated uses are: Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, Recreation, Irrigation, Livestock Watering & Wildlife, and Navigation. The Tennessee 2000 305(b) Water Quality Report notes the water quality is

good in the river segment of the proposed work. Four dischargers are located upstream of the project area.

3.2 Aquatic Resources

The Pickwick Dam tailwater is a renowned fishery and is perhaps the best remaining mussel habitat in the Tennessee River. Flows are relatively high and the main channel has a shifting bed load of coarse sand and gravel. Where the sediments settle, the resulting sand and gravel substrate constitutes excellent aquatic habitat. River sand and gravel is also considered the best road aggregate material, and commercial extraction operations have likely been an additional factor responsible for significant changes in aquatic habitat conditions. Recent modifications to Department of the Army Permits for commercial sand and gravel dredging have restricted extraction operations to specific locations on the Tennessee River. Generally, these permitted areas are highly disturbed and thought to contain few mussels. Habitat is generally considered least stable at the most recent commercially dredged sites because of the frequency of disturbance and the high rate of deposition. With this in mind, a commercial sand and gravel permitted area was selected as a surrogate site to perform the experimental mussel relocation method as opposed to the sensitive habitat and community that had developed at the proposed maintenance dredging site at Diamond Island.

On May 22, 2002, a survey was performed by TWRA to characterize the aquatic habitat and mussel composition and densities in the surrogate site located on the left descending bank between TRM 195.0-194.0. Removal and relocation sites were located by TWRA within this river reach. The selected removal site contained 10 mussel species. Using a timed search, mussels were collected at a rate of 10 mussels per minute. The selected relocation site contained 12 mussel species. Using a timed search, mussels were collected at a rate of 4 mussels per minute. One Pink mucket (*Lampsilis abrupta*) was found at the selected relocation site. TWRA personnel removed and relocated the endangered mussel individual from the site.

The aquatic habitat at the removal site consists of gravel and sand. The river substrate is relatively flat with some minor furrows. The aquatic habitat, at the replacement site, consists of sand and silt near shore, and gravel near mid-channel. The irregular bottom contour results in variable depths ranging from 20 – 30 feet. Placement of material in this area has the potential of providing more suitable mussel habitat by aiding in the development of more regular and relatively flat river bottom contours.

In 2001, TVA rated the ecological health of Kentucky Reservoir as good. The fish community was rated as good based on the large number and diversity of healthy fish collected. Monitoring results rated the benthic community as good due to the diversity of organisms collected.

The river reach below Pickwick Lock and Dam has historically supported major freshwater mussel populations. A Mussel Sanctuary was established by TWRA below Pickwick Lock and Dam at TRM 206.7, downstream to TRM 201.9. The river reach below the sanctuary is valued for the high quality and density of commercial mussels.

3.3 Terrestrial Resources

The landuse surrounding TRM 195.0-194.0 is dominated by agriculture. Row crops flank both sides of the river. There are small bands of riparian woods and shrubs adjacent the river on top of the bank. The town of Crump, Tennessee, is located about ½ mile downstream of this river reach. Wildlife would be expected to include white tailed deer, raccoons, rabbits, opossum, turtles, squirrels, and waterfowl. These animals are known to adapt to areas of high human activity.

3.4 Endangered and Threatened Species

In 1990, an Environmental Assessment reviewed river reaches that were permitted for commercial sand and gravel extraction. During this evaluation, environmentally sensitive areas in the Tennessee River were identified and removed from the permit. By this action, occurrence of endangered species or essential habitat in the remaining permitted areas that had been actively mined was considered unlikely. At that time, no listed species were known to occur on the left descending bank of the Tennessee River between miles 194.0 to 195.0. Therefore this reach remained under permit. The EA further noted that if new information revealed listed species within the permitted area, then avoidance or consultation under the Endangered Species Act would be initiated.

Federally and State listed mussel species are sometimes found in commercial mussel beds. Occasionally commercial beds populate the shoals that have developed in and adjacent the authorized navigation channel. The premise made was that listed species could possibly be found in all mussel beds. On June 27, 2002, a letter was received from the Tennessee Department of Environment and Conservation, Division of Natural Heritage. A list of state and federal endangered and threatened species within Hardin County was provided. Specifically, their records indicated that endangered and threatened mussel species had been recorded in the vicinity. One count occurred within TRM 194.0-195.0.

On May 22, 2002, TWRA conducted a survey in this river reach to investigate potential removal and relocation study sites for the proposed mussel relocation experimental method. During this investigation, TWRA located a Pink mucket (*Lampsilis abrupta*) within the potential relocation site. The mussel was removed from the area and placed in an area of suitable habitat. Discovery of a listed species within the proposed experimental area initiated a request for consultation under Section 7 of the Endangered Species Act.

3.5 Cultural Resources and Historic Properties

Under Section 106 of the National Historic Preservation Act, notification of the proposed action was sent to the Tennessee State Historic Preservation Officer (SHPO). Public Notice 43-02 dated May 29, 2002, contained a map marking the proposed experimental area between TRM 194.0 and 195.0. The proposed area was located off shore in open water. This river reach has been previously disturbed by commercial sand and gravel extraction activities. Coordination with the SHPO was necessary to determine if there were any National Register of Historic Places listed, or eligible properties affected by this proposal.

3.6 Navigation and Safety

The selected removal and relocation sites are located outside the navigation channel. Water depth is over 20 feet deep. The proposed activity is expected to take a week to complete. The clamshell dredge and dump scow would be used in the experiment for approximately 1-3 days, depending on set-up, use, and breakdown time. The proposed action is not expected to affect safety or navigation since the activity is outside the authorized channel.

The proposed experimental removal and placement sites would be marked with buoys to keep waterborne traffic out of the area. Additional flagging would be used when divers are performing work in accordance with the Corps safety manual.

3.7 Contamination

The Tennessee Valley Authority (TVA) Reservoir Vital Signs Monitoring Program evaluates appropriate physical, chemical, and biological indicators in the tailwater of Pickwick Dam within the Kentucky Reservoir. The TVA Program provides basic information on the “health” or integrity of the aquatic ecosystem in the reservoir. Currently there are no swimming or fish consumption advisories within the project area indicating no bacteriological or fish tissue contamination in this section of the river. The TVA reported good ratings in the Kentucky Reservoir sediment quality.

The 404(b)(1) Guidelines, Subpart G, states that dredged material consisting of sand, gravel, or other naturally inert material, is not likely to be contaminated. Also, if the dredge material is a sufficient distance from any pollution source, it is probably not contaminated.

3.8 Air Quality

The proposed dredge and disposal sites are within an attainment area under the Clean Air Act.

3.9 Floodplains

The proposed activities occur within the Tennessee River and associated floodplain. Water levels are generally controlled by the operation of Pickwick Dam. Floodwater heights can be affected by both the backwater effects from Kentucky Reservoir and river flows. For Kentucky Reservoir, the winter pool elevation is 354.0 and the summer pool elevation is 359.0. The 100-year and TVA Flood Risk Profile (FRP) elevations at TRM 195.0 would be 398.4 and 400.7 respectively. These elevations can be used for the length of the relocation site because they change very little over this reach. At this location, the FRP is equal to the 500-year flood elevation.

3.10 Environmental Justice and Socioeconomics

The 1994 Executive Order 12898: “Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations” requires Federal agencies to identify and address any disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

As defined by the “Draft Guidance For Addressing Environmental Justice Under NEPA” (CEQ, 1996), a minority population exists where the percentage of minorities in an affected area either exceeds 50% or is significantly greater than in the general population. Minority populations in Hardin County comprised nearly 5% of the total population in 2000.

Low-income populations are identified using the Census Bureau’s statistical poverty threshold. The Census Bureau defines a “poverty area” as a Census tract with 20% or more of its residents below the poverty threshold. In 1997, about 14% of the State citizens lived below the poverty level. The 1997 poverty level in Hardin County was approximately 18%, which was above the State average, but below the Census Bureau’s poverty threshold. This representation is less than the 20% that would define the area as a “poverty area.”

Based on the 2000 U.S. Census, Hardin County contained approximately 25,800 residents. This represents nearly 0.004 % Tennessee’s total population (5,740,000). The 1997 median household income for the State of Tennessee was approximately \$32,000 dollars. The 1997 median income for Hardin County was \$25,800, which was slightly below the State average.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Water Quality

Without the project, water quality would remain unchanged. With the project, water quality effects would include temporary, short-term, and highly localized periods of turbidity and suspended solids at the selected removal and relocation sites. The material at the removal site consists of gravel and sand. Given the large particle size, suspended solids would settle out quickly. Placement at the relocation site is expected to have the same effect on water quality. Localized turbidity would result from suspended solids composed of mostly sand, during placement operations. This effect would not impair designated uses nor release any contaminated sediment into the water column. Compared to the amount of turbidity and suspended solids observed during flooding conditions, the effects caused by the Proposed Action are insignificant. Four dischargers are located upstream of the project area. Pollutants could stress the mussel populations resulting in increased vulnerability to other effects.

4.2 Aquatic Resources

Under the No Action alternative, aquatic habitat would not be disturbed. Mussel relocation methods would remain limited. The purpose of the proposed action is to test the experimental mussel relocation method to determine if this method could be used as a viable method to safely remove large numbers of mussels. Unlike diver removal methods, this method minimizes mussel handling and transport time. In addition, this method increases the likelihood of collecting the greatest range of size classes within the mussel population.

The primary adverse impacts from the Proposed Action would occur to aquatic organisms and their habitat, during the excavation, disruption, relocation, and covering of the substrate. Removal and placement of material would result in a temporary reduction in the local density and distribution of fish and benthic organisms. Fish are mobile and would quickly repopulate the area after the completion of the proposed experiment. Since the proposed action would occur in September, fish spawning activities would not be affected.

Precautions would be taken to minimize impact to resident mussel populations. Resident mussels would be removed from the relocation site and located outside the footprint of the affected area. Resident mussels dredged from the removal site would be dispersed in a thin layer over the selected relocation site with the gravel and sand substrate to minimize the effects of burial. Relocated mussels would be monitored to determine the affects of the proposed experimental removal method on their health and survival. The total area affected by the experiment is estimated to be approximately one acre. This is considered insignificant when compared to the total area of the similar habitat located in the Tennessee River system. The sites are expected to re-colonize quickly due to natural drift from upstream. Since the proposed work is scheduled for September, water temperature is expected to be greater than 60^o F. Freshwater mussels have increased mobility when the water temperature is greater than 60^o F, and would have the best change of migrating through a thin layer of substrate that could cover them at the selected relocation site.

Benthic organisms at the selected removal site could be either crushed or injured during the removal activity. This impact is unavoidable, however the loss of a few individuals is not likely to affect the continued existence of the benthic community as a whole since many other similar populations exist within the Tennessee River system. The substrate at the dredge site consists of gravel and sand. The substrate at the placement site consists of sand and silt. The larger particle size of the dredge material is considered more suitable mussel habitat and therefore would offer some improvement at the placement site.

4.3 Terrestrial Resources

The proposed activity would occur within the river. During the proposed removal and relocation activities, terrestrial wildlife may be disturbed by the activities and move out of the immediate area temporarily. However, the size of area affected is very small and the predators, waterfowl, raccoons, and muskrats, are very mobile and can seek food elsewhere. On completion of the proposed activities, wildlife would be expected to return to pre-project conditions. Therefore, no long-term impact to terrestrial wildlife would be expected.

4.4 Endangered or Threatened Species

On June 27, 2002 a letter was received from the Tennessee Division of Natural Heritage outlining general and specific comments regarding the proposed experimental mussel relocation method with respect to state and federal threatened and endangered species. A letter was issued August 27, 2002. All comments were addressed either within the letter or with reference to the enclosed proposal: An Evaluation of Methods to Safely Remove Freshwater Mussels prior to Maintenance Dredging.

On May 22, 2002, TWRA conducted a mussel survey in the proposed experimental area. Divers searched the proposed experimental mussel removal and relocation sites. TWRA personnel found one federally listed species, a pink mucket (*Lampsilis abrupta*), which was removed from the proposed experimental mussel placement area.

In accordance with Section 7 of the Endangered Species Act, and conditions specified in the commercial sand and gravel permit, the Corps and TVA initiated consultation with the USFWS via a letter dated June 11, 2002. The letter noted that many precautions would be taken during this proposed experiment to adequately ensure the health, survival, and adequate monitoring of the mussel resources affected by the proposed project. Given the actions in progress, and planned, to safeguard the mussel resources, and given the small volume of material and small footprint areas within both the proposed removal and relocation areas, the Corps and TVA believed that the proposed project was not likely to affect the continued existence of any State or Federally listed species.

Comments received on June 26, 2002 from the U.S. Fish and Wildlife Service regarding the proposed project recommended initiation of formal consultation with the discovery of an endangered mussel, a single pink mucket, within the footprint of the project and requested clarification on mortality measures and monitoring. The Corps and TVA initiated formal consultation via a letter dated July 24, 2002. Specific measures to document effects of the mussel relocation method were outlined under each task section within the proposal. In conclusion it was noted that agencies knowledgeable in mussel resources would need to evaluate the data collected after completion of the experiment to determine the effectiveness of this relocation method. On September 9, 2002, a Biological Opinion was received from the USFWS concluding that the evaluation of an alternative method for removal and relocation of freshwater mussels prior to dredging operations was not likely to jeopardize the continued existence of listed mussel species. Additionally, the proposed experiment was not likely to destroy or adversely modify designated critical habitat. No critical habitat has been designated for the listed species identified in the biological opinion, therefore no such habitat would be affected. As a result, the USFWS concurred that implementing the proposed action would not likely affect the continued existence of any threatened or endangered mussel species within the footprint of either the selected removal or relocation sites. In conclusion, the Coordination Act and Section 7 of the Endangered Species Act had been fulfilled.

4.5 Cultural Resources and Historic Properties

The proposed project was coordinated under Section 106 of the National Historic Preservation Act. With or without the project, neither listed sites on the National Register of Historic Places, or eligible properties would be affected. All proposed activity would occur off shore in open water, and within an area disturbed by commercial sand and gravel extraction.

On June 13, 2002, a letter was received from the Tennessee Historical Commission in response to the Public Notice No. 02-43, dated May 29, 2002. In the opinion of the SHPO, there were no National Register of Historic Places listed or eligible properties

affected by this project. Therefore the SHPO had no objections in proceeding with the project.

4.6 Navigation and Safety

With or without the project, navigation and safety are not expected to be affected. The proposed activities are planned to occur outside the navigation channel. However, to ensure the safety of personnel involved with the project, the selected removal and relocation areas would be marked to prevent access into the area during the project. Divers would follow the Corps safety manual when conducting the work.

4.7 Contamination

With or without the project, contamination would not be affected. The dredge material from the selected removal site consists of gravel and sand. Due to the type and particle size of the material, contaminants are not expected to adhere to the particles. The surrounding area is predominantly agricultural, with no obvious source of contamination; therefore, the material at the experimental sites is believed to be clean, uncontaminated, natural material.

The TVA ecological health rating in 2000 noted that sediment within the Kentucky was rated as good. A good rating means that the reservoir bottom is free of pesticides and that PCBs and metal concentrations are within expected background levels.

4.8 Air Quality

With or without the project, the Air Quality would not be affected. The proposed work is within an attainment area under the Clean Air Act. Short-term, localized impacts resulting from equipment exhaust emissions would be negligible and is not expected to affect the general air quality within Hardin County.

4.9 Floodplains

The proposed project involves dredging about a 1-foot layer of the river substrate along with the mussels residing there. The material will be placed in a split hulled dump scow and redeposited at the experimental mussel relocation site a short distance downstream from the dredging site. For compliance with Executive Order 11988, dredging is considered to be a repetitive action in the floodplain that should result in minor impacts if the excavated material is spoiled outside of the floodplain. However, for this project the mussels must be relocated in the water in a substrate condition similar to the dredging site from which they were removed. Therefore, there is no practicable alternative to relocating the material within the reservoir. Adverse impacts would be minimized because the river bottom elevation and the channel configuration at the relocation site would not be expected to change enough to increase flood elevations.

4.10 Environmental Justice and Socioeconomics

The proposed action would not present a disproportionate adverse impact on any segment of the population, including minority or low-income people or communities. The aquatic resources are accessible to all citizens regardless of race, color or creed. Commercial operations involving mussel collections or sand and gravel extraction would not be

significantly affected. These activities could continue to operate in other reaches of the river. The footprint of the proposed action covers less than 1 acre, which is significantly smaller than the total available area open to these commercial activities. If successful, the experimental relocation method could be beneficial to shell industry. A safe way to relocated large numbers of mussels would sustain this resource and would aid its availability to that segment of the population that depends on this resource for a living. The commercial sand and gravel industry could be inconvenienced by the project for a short period of time. Monitoring the relocated mussels is scheduled for approximately one year.

4.11 Cumulative Effects

The potential resources cumulatively affected by the experimental relocation project are mussels and the sand and gravel habitat. Historically the Tennessee River was, and still is one of the richest rivers in the world in aquatic biodiversity. Human activities within the last 50 years have exerted cumulative impacts on the aquatic ecosystem as human populations and demands on the aquatic resources increased. The health, safety, and economic well being of the human population has been the priority as demands for electricity, navigation, water supply, flood control, recreation, and flow augmentation for wastewater assimilation were met. Commercial and recreational needs also placed demands on aquatic resources such as sand and gravel, mussels and fish. To meet many of these demands, the river was altered from a free-flowing river system to a slower and deeper reservoir system with the construction of a series of dams.

Endemic freshwater mussels were arguably hit hardest by the cumulative impact resulting from the physical and water quality changes in the river system. Many mussel species were either extirpated, or became endangered or threatened. Any activity affecting them or their habitat became a concern. Mussels are important because they are sensitive to water quality and habitat changes. They have been used as indicators of aquatic ecological health. Conserving mussel populations provides a means to measure the aquatic environment. If these populations can sustain themselves, then the rest of the aquatic fauna are also likely doing well. Sustaining healthy aquatic communities sustains commercial and recreational fishing and musseling. Healthy aquatic communities indicate good water quality, which supports safe recreation, and secure public water supplies.

Maintenance dredging affects mussels living within or along the navigation channel. The channel is a permanent feature within 652 miles of the Tennessee River with specific requirements for its depth, width, and location. During high flows, the river substrate consisting of cobble, gravel, and sand, is transported downstream along the riverbed. Over time, these deposits shoal at certain locations within the navigation channel and reduce the channel's width and depth. These pinch points create grounding hazards for river traffic and, without maintenance, eventual occlusion of the channel. Many of these pinch points also provide suitable mussel habitat as evidenced by the mussel beds these areas often develop.

Over the last 50 years, approximately 30 sites have been dredged within the Tennessee River. These sites add up to approximately 40 river miles that required periodic maintenance dredging. Some sites have been dredged many times (every 8-10 years) due to the high rate of bedload accumulation. At some dredge sites, mussels are found in very high concentrations. Concurrently, mussels often colonize the disposal site since this composition of predominantly gravel and sand appears to meet their life requirements. These disposal sites created additional mussel habitat that allowed the mussels to colonize resulting in a positive effect by increasing their numbers. It is important to note that these effects have occurred with the use of standard dredging and open water disposal procedures. However, colonization at disposal sites have taken many years to establish viable beds. This lag time could be the result of fragmenting the population with routine dredging operations. The experimental mussel relocation method attempts to keep much of the community intact by carefully removing the one foot of substratum where large numbers of varying size classes of mussels live. Dispersing these mussels in a thin layer minimizes burial since it is expected that the larger gravel and individuals settle first followed by the smaller gravel and smaller individuals that settle closer to the surface. A fast, efficient, and least damaging method of mussel removal is needed to remove large communities of mussels in order to minimize disruption in reproduction and growing size classes. The substrate that sustained the mussels is relocated with them. In the long run, this method could be expected to save large numbers of mussels and expand their habitat since mussels and their required substrate are moved together. The cumulative effect could be beneficial. Keeping the community intact could minimize lag time of developing mussel beds. Moving the substrate with the mussels ensures appropriate habitat. Placement at appropriate disposal sites could expand viable mussel habitat resulting in a net gain of mussel resources.

Federally and State listed mussel species are sometimes found in commercial mussel beds. Occasionally commercial beds populate the shoals that have developed in and adjacent the authorized navigation channel. The premise made is that listed species are likely to be found in all mussel beds. Because these listed species are rare even in a mussel bed, as a precaution, many techniques have developed to relocate all mussels. These techniques of mussel removal use divers to hand remove mussels individually, or use a suction dredge guided by divers, to remove mussels out of an area requiring maintenance dredging. These methods also removed commercial mussels as well since positive identification is usually not made until the mussel is brought to the surface. If the mussel beds are small, mussel removal by divers could be done within a matter of a few weeks. But for large beds, removal could take several months. This may not be practical in terms of time, labor, and expense. An alternate mussel removal method that could remove large numbers of mussels in a short time, needed to be developed for these large beds. This alternative method is the experimental mussel relocation method. It does not use divers to remove mussels. It uses dredging equipment to move large numbers of mussels.

Within the next 50 years, it is reasonably foreseeable that navigation traffic will continue and grow with increased demands for commercial products and recreational boating. Maintenance dredging activities will be necessary to ensure safe passage of river traffic as long as shoaling occurs within the authorized channel. If mussel beds develop in shoaling

areas that require maintenance dredging, then an impact to the mussel bed may be unavoidable. A safe, efficient, and quick removal method to relocate large mussel communities prior to maintenance dredging is needed to minimize impact to the mussel resource. A safe, efficient and quick dispersal method at appropriate disposal sites would be also needed to increase the likelihood of cultivating new beds outside the authorized navigation channel. The proposed experimental mussel relocation method attempts to facilitate this process. The expected cumulative effect of the experimental relocation method would be to maximize survival of mussels relocated by dredging, and minimize community burial at the appropriate disposal site in order to produce sustainable benthic communities and a credible positive gain in mussel resources.

Because of the small area affected and the precautions taken in relocation, performing the experimental mussel relocation method is not likely to cause the mussel resource to exceed a threshold of no return. The cumulative effect of repeating this action several times within the river system may be positive. The removal of large numbers of mussels would benefit the mussels by moving communities containing a wide range of class sizes.

The mussels would not be handled. Transportation time would be relatively short from dredge to disposal site. Keeping the mussels wet while in transport reduces the risk of desiccation. Moving the river substrate with the mussels ensures they have appropriate habitat of sand and gravel. Placement in an appropriate site that meets mussel requirements could create additional mussel habitat. This effect has been documented in the back chute of Wolf and Diamond Island where past disposal sites were colonized by mussels. The expected cumulative effect of these actions could be increased mussel numbers including possible listed species. This effect could indirectly aid in endangered species recovery. Increased mussel numbers would benefit the ecosystem by providing more food to organisms that feed on the mussels.

From the human aspect, the risk of injury or even possible death would be greatly reduced because the need for divers would be greatly reduced. From an operations aspect, the experimental mussel relocation method could be of great value to Corps districts that must maintain navigation channels with mussel resources that may or may not contain listed species. The same equipment that is used in dredging would be used in mussel relocation with modifications to operating procedures. Relocating large numbers of mussels by this method could be done relatively quickly in comparison to methods that use divers. The expected cumulative effect of using the experimental mussel relocation method for the Corps, could translate into a savings in dredging time and cost in comparison to current mussel relocation methods employing divers. Specifically, this action would support the Corps – Nashville District mission to maintain natural resources assets such as freshwater mussels.

5.0 ENVIRONMENTAL COMMITMENTS

5.1 Environmental Safeguards

On June 11, 2002, a letter was sent to USFWS reporting the find of a listed species within the footprint of the selected relocation site. The letter noted that the experimental proposal contained measures to safeguard the mussel resources within the experimental

sites. The Corps would also employ divers to conduct a second survey within the selected removal and replacement areas prior to any action. Quantitative and qualitative mussel samples would be collected from both sites. Mussels found within the footprint of the proposed placement site would be removed and relocated outside the experimental area. Other measures to ensure continued well-being of the all the mussels, including listed species, were noted in the June 11, 2002 letter and described in the experimental mussel relocation method proposal (Appendix A).

If appropriate measures are implemented, impacts to the freshwater mussel populations and to the environment could be minimized. Additional measures that would be employed to minimize impacts from the proposed action include the following:

- The anticipated volume of dredged substrate would be about 1000 cubic yards.
- The dredged material consists of clean and natural gravel and sand that does not carry contaminants at levels that would degrade the proposed placement site.
- The proposed experiment is a small job. The footprints of the dredge and placement activities affect about 1 acre.
- The proposed activities would occur in the early fall. This would avoid fish or mussel spawning activities.
- In September, the water temperature is expected to exceed 60°F. Mussels are more mobile with warm water temperatures.
- The project was coordinated with the appropriate state and federal agencies.
- A second mussel survey will be conducted at both the dredge and placement sites. Any listed species would be safely removed and placed outside the experimental area.

We believe that a clamshell dredging operation could be modified to minimize mussel mortality. The following recommendations are based upon discussions with individuals knowledgeable on dredging and ERDC experience with freshwater mussels:

- The operator should take only the top 12 in of material that contains most of the living mussels.
- The receiving barge should only be partially loaded with material.
- Dredged material should be sprayed with water to keep it moist during prolonged loading and transport.
- Dredged material would be taken to an area with appropriate depth and substrate composition.
- Handling time should be kept to a minimum.
- Dredged material should be carried in a dump scow, then released gradually while the vessel is moving so the mussels and dredged material are spread in a thin layer.

With adherence to the above measures, it is anticipated that impact to the mussel resources would be minimized.

6.0 AGENCY COORDINATION AND ENVIRONMENTAL COMPLIANCE

6.1 Section 404 of the Clean Water Act (33 U.S.C. 1344)

Material dredged from the removal site would be placed in open water at the relocation site. This action is subject to Section 404 of the Clean Water Act. Public Notice 02-43 was released on May 29, 2002 inviting public comment on the proposed action. A Section 404(b)(1) evaluation for discharges of dredged or fill materials into the waters of the United States has also been prepared for the proposed project (Appendix B). The 404(b)(1) evaluation notes that the proposed discharge of dredged material meets the requirements of the EPA Section 404(b)(1) Guidelines.

6.2 Aquatic Resource Alteration Permit (ARAP)

An Aquatic Resource Alteration Permit, which serves as Water Quality Certification pursuant to Section 401 of the Clean Water Act, and pursuant to 33 USC 1341, must be obtained from the Tennessee Department of Environment and Conservation (TDEC) prior to open water placement of dredged material. The Nashville District received certification on September 12, 2002 (Appendix C). The certification is subject to standard conditions included in the permit document. (Additional Conditions may apply to the ARAP and will be discussed once ARAP has been obtained).

6.3 Fish and Wildlife Coordination Act (FWCA)

Under this Act, Federal agencies are required to consult with and give strong consideration to the views of the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and State wildlife agencies regarding the fish and wildlife impacts of projects that propose to impound, divert, channel, or otherwise alter a body of water.

On April 29, 2002, an inter-agency meeting was conducted to discuss methods of mussel relocation that would reduce the impacts of proposed maintenance dredging. Participants included representatives from TWRA, USFWS, TVA, and Corps. During these discussions, an alternative experimental mussel relocation method was proposed. Input was requested and received from all agencies and used in the development of the final proposal: An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging, found in Appendix A

6.4 Endangered Species Act

On May 22, 2002, TWRA conducted a mussel survey in the proposed experimental area. TWRA searched both the proposed experimental mussel removal area (Tennessee River Mile 194.8) and the proposed experimental mussel placement area (Tennessee River Mile 194.6). TWRA found one federally listed species, a pink mucket (*Lampsilis abrupta*), which was removed from the proposed experimental mussel placement area. Based on this information, the Corps – Nashville District, entered into informal consultation under Section 7 of the Endangered Species Act. The Biological Opinion issued by the USFWS on September 9, 2002, concluded that the proposed experimental mussel relocation

method was not likely to jeopardize the continued existence of federally listed species nor destroy or adversely modify any critical habitat as no such habitat has been designated.

6.5 Cultural Resources Requirements

Section 106 of the National Historic Preservation Act of 1966 requires Federal agencies to take into account the effects of their undertakings on properties included in or eligible for the National Register of Historic Places. They must afford the Advisory Council on Historic Preservation an opportunity to comment on such undertakings. Regulations guiding this process, defined at 36 CFR Part 800, require identification and evaluation of potentially affected historic properties, assessment of adverse effects, and resolution of adverse effects through consultation with the State Historic Preservation Officer, and, if necessary, the Advisory Council.

In response to Public Notice 02-43, the Tennessee Historical Commission issued a letter dated June 13, 2002. In the opinion of this office, no properties listed or eligible for the National Register of Historic Places would be affected by this project.

6.6 Environmental Justice Executive Order

Executive Order 12898 requires Federal agencies to promote “nondiscrimination in Federal programs substantially affecting human health and the environment.” In response to this direction, Federal Agencies must identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

The proposed experiment does not present a disproportionate adverse impact on minority, low-income households, or communities.

6.7 Clean Air Act and Clean Air Act Conformity Rule

The proposed maintenance dredging and disposal is subject to the Clean Air Act, as amended (432 U.S.C. 7401 et seq.). The proposed work would occur in an attainment zone for purposes of the Clean Air Act General Conformity Rule. The requirements of 40 CFR Part 51, Subpart W, apply to the proposed action. Section 51.853 of the Subpart lists exemptions to the general conformity provisions. The action is not considered to be regionally significant and would not exceed the specified emission rates within the attainment area. This proposed project is considered to conform to the State Implementation Plan.

6.8 Hazardous, Toxic and Radiological Wastes (HTRW)

The river substrate material at the proposed removal site consists of inert gravel and sand. Because contaminants do not generally adhere to material of large grain size, testing for the 404(b) (1) Evaluation was not required. The site is believed to be clean so no additional testing was proposed.

6.9 TVA Act

The proposed experimental mussel relocation method falls under the 1962 *Memorandum of Agreement between the Department of the Army and Tennessee Valley Authority for*

Construction, Operation, and Maintenance of Navigation Facilities on the Tennessee River and its Tributaries. For this project, TVA is a Cooperating Agency under NEPA.

6.10 Floodplain Executive Order

Executive Order 11988, Floodplain Management, requires federal agencies to evaluate and minimize impact on floodplains. This project does occur within the Tennessee River floodplain. However, there is no practical alternative to relocating mussels outside the river or its floodplain. Additionally, no obstruction would be created as a result of this project, therefore a 26a permit is not needed.

6.11 Wetlands Executive Order

Executive Order 11990, Protection of Wetlands, requires Federal agencies to protect wetlands. No wetlands would be affected by this project. Project activities are confined to open water.

7.0 PUBLIC INVOLVEMENT

7.1 Scoping and Public Notice Notification

Public Notice, No. 02-43, was circulated on May 29, 2002. This notice served as scoping, to solicit comments from the public, governmental agencies and officials, Indian Tribes, and other interested parties, that should be considered and evaluated with respect to potential environmental impacts of this proposed activity. Comments regarding environmental issues would be addressed in the course of the NEPA process. The Public Notice also served as a Notice of Availability of and Environmental Assessment for the proposed activity. Appendix D contains the Public Notice and related correspondence.

7.2 Consideration of Public Comments

Prior to the issuance of Public Notice 02-43 on the proposed work, an inter-agency meeting and several telecommunication exchanges between the Corps, TVA, USFWS, TWRA and TDEC resulted in the exchange of information and discussion of potential concerns with the agencies. This action resulted in the development and refinement of the proposed experimental mussel relocation method to minimize environmental concerns as a result of input from these agencies.

8.0 CONCLUSION

Based on this Environmental Assessment, proceeding with the work would comply with EPA Section 404(b)(1) Guidelines.

In general, the overall effects of implementing the experimental mussel relocation method would result from:

- Removal and open water placement of river bottom substrate
- Temporary changes in water quality (increase turbidity and suspended solids)
- Potential localized effects on fish and,
- Direct, localized, and temporary affect on mussel resources.

These affects represent unavoidable, but temporary and localized impacts. Completion of the proposed experimental mussel relocation method would provide a measure of effectiveness of this method in its use to relocate mussels.

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10.0 LIST OF PREPARES

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| Appendix A | Experimental Mussel Relocation Proposal | A -1 |
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**An Evaluation of Methods to Safely Remove
Freshwater Mussels Prior to Maintenance Dredging**

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Working Draft

An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging

Background

The U.S. Army Engineer District, Nashville (LRN) identified areas within the Tennessee River navigation channel near Diamond Island (River Mile (RM) 196) that require maintenance dredging. Based upon a survey conducted by the Tennessee Valley Authority in 1999, two of three areas that require dredging support high-density mussel populations dominated by *Fusconaia ebena*, *Quadrula pustulosa*, *Obliquaria reflexa*, and *Ellipsaria lineolata*. Although no federally listed species have been found in these areas, this river reach is within the range of several uncommon species, notably *Lampsilis abrupta* and *Plethobasus cooperianus*, both listed as endangered. The two areas that support high-density mussel populations cover 4.3 acres (approximately 17,410 square meters). Based on an average density in these two areas (66.4 individuals/sq m), approximately 1.1 million mussels could be affected by dredging.

Freshwater mussels are an important component of the ecosystem; they recycle calcium and magnesium, filter organic matter out of the water column, and provide food for certain fishes, mammals, and waterfowl. The calcium carbonate shells of freshwater mussels were once used to make buttons; today, thick-shelled species are collected for use in culturing pearls. The Endangered Species Act of 1973 as amended, prohibits the Federal government from engaging in any activities that could negatively affect threatened or endangered species.

The LRN has considered several alternatives for reducing the impacts of proposed maintenance dredging. One alternative would be to have divers to collect all mussels by hand and then relocate them to another area. Another alternative would be to collect mussels with a diver operated suction pump. More mussels could be removed with a suction dredge with a 4 to 8 in (10 to 20 cm) intake pipe than a diver could collect by hand. Regardless of the method being used, some mussel mortality is inevitable. Mussels could be damaged through handling, temporary storage before relocation, or replacing them in the water.

Scientists at the U.S. Army Engineer Research and Development Center (ERDC) propose an alternative to removing mussels from a sensitive area to be dredged that would not require the use of divers. This alternative method consists of modifying the standard dredging procedure to remove as many mussels as possible using a clamshell dredge, then transport them to an appropriate relocation site. At a recent meeting in Nashville, attended by representatives of Tennessee Wildlife Resource Agency, U. S. Fish and Wildlife Service, Tennessee Valley Authority, LRN, and ERDC (29 April 02), this alternative method for removing mussels was discussed. Meeting attendees agreed that the method had merit and should be tested, but not at the Diamond Island site which is known to support valuable mussel resources.

The purpose of this document is to describe a test of this alternative for dealing with mussels at a site that requires maintenance dredging. This proposed test would be conducted in a reach of the Tennessee River near Diamond Island that has a relatively low abundance of mainly common species of native mussels. Specifically, this test will be conducted between Tennessee River Miles 194 and 195, left descending bank.

An Alternative Method of Removing Mussels

A Typical Dredging Operation. A typical dredging operation for the Diamond Island project would consist of a 3-cubic-yard (2-cubic-meter) bucket and a 300-cubic-yard (229-cubic-meter) split hull barge to transport material. If the disposal area was close, the barge could be filled and emptied approximately 10 times per day. At this rate approximately 3,000 cubic yards (2,294 cubic meters) of material could be moved in a day.

Removal of Mussels from the Area Using Divers. Personnel from LRN estimated that a dive crew (with two divers working simultaneously) could collect and remove live mussels from approximately 270 square meters during a working day. At this rate the crew could cover approximately 1 acre (4046.8 square meters) in 15 days. It is likely that these divers could cover 3 or 4 times this area (as much as 1,000 square meters per day) if they only concentrated on large, easily observable, or unusual (possibly rare or endangered) mussels. In addition to the collecting, additional time would be needed to transport and replace the mussels in a new area. This would probably take approximately half the time (or less) than required to collect the mussels.

The amount of time to remove mussels by hand for this project could be approximately 64 days (4.3 acres x 15 days/acre). This does not include time to replace the mussels, which would either add more time or more personnel to the project. The cost of a 5 or 6-person dive crew, plus any support personnel from the District, could be \$3,000 to \$5,000 per day. Therefore the cost of removing all mussels from the area could be \$192,000 (64 days x \$3,000/day). This does not include time required to transport and replace the mussels. Obviously the total cost could be reduced by any one of several options such as 1) not removing all of the mussels, 2) having the divers selectively collect for only certain species, or 3) using a suction dredge.

It is likely that the same crew could cover 2 or 3 times the area if they used a hand-held suction dredge to remove mussels. Time to replace the mussels would not change, since this would all be done by hand. It is difficult to judge differences in mortality between collecting by hand and using a small suction dredge. It is possible that the suction dredge could cause slightly more mortality than collecting by hand, although this has not been tested. Mortality can also be caused by difficulties in handling, holding, and replacing mussels, unrelated to collecting methods.

An Alternative to Using Divers to Remove Mussels. It is usually assumed that mussels will all be killed during a dredging operation. Mortality could be caused by action of the

clamshell, by desiccation while the material is being held or transported, or burial after the material is disposed. In addition, mussels could be killed if the material is placed in an inappropriate area. However, we are not aware of any studies that quantified mussel mortality associated with a dredging operation. It is important to note that there is anecdotal information about mussel survival (as well as mortality) associated with dredging. For example, in 1999 a dredge operator in the Huntington District reported collecting live mussels exiting a pipeline from a hydraulic dredge being used in the Muskingum River. We examined the area later and found many living adult mussels in the disposal area, which were probably those mussels observed by the operator.

We believe that a clamshell dredging operation could be modified to minimize mussel mortality. The following recommendations are based upon discussions with individuals knowledgeable on dredging and our own experience with freshwater mussels:

- The operator should take only the top 12 in (30.5 cm) of sediment that contains most of the living mussels
- The receiving barge should only be partially loaded with dredged material
- While on the barge, dredged material should be sprayed with water to keep it moist during loading and transport
- Dredged material would be taken to an area with appropriate depth and substrate composition (good mussel habitat)
- Handling time should be kept to a minimum
- Dredged material should be carried in a dump scow, then released gradually while the vessel is moving so the mussels and sediments are spread in a thin layer

We propose that the above described procedure, if conducted carefully, could result in greater overall mussel survival than an operation designed to collect only a portion of adult live mussels by hand, with the rest disposed in an inappropriate location. Sites near Diamond Island will not be used for this test. This test will be done between Tennessee River Miles 194 and 195 that is currently permitted for sand and gravel dredging.

Divers would be used to examine dredging and disposal areas prior to the action. In addition, divers could be used to collect information on mortality at specific time intervals (24 hours, several weeks, and 12 months and/or into November 2003) after dredging. If successful, modified dredging methods tested by this study could be of great value to USACE districts that must maintain navigation channels with valuable mussel resources. If deemed appropriate, this method of removing mussels could be applicable to Diamond Island.

We propose the following to test effects of a modified dredging operation on mussel mortality.

Approach

Task I: Preliminary Evaluation of the Areas. Divers will collect qualitative and quantitative samples for freshwater mussels from the area to be dredged and the disposal area. Divers will use timed searches (usually 2 divers at 30 min each) to obtain mussels. All live mussels will be counted and identified following nomenclature in Williams et al. (1992). The coordinates of all sample sites will be marked with a hand held Global Positioning System (GPS). Coordinates will be used to print accurate maps and can be transferred to USGS topographic maps or any type of mapping system.

Quantitative (total substratum) samples (0.25 sq meter) will be taken from the area to be dredged and the disposal area. Divers will collect 10 quantitative samples from at least 3 sites within each of the two areas (a total of 60 samples would be collected). The purpose of the quantitative samples is to provide unbiased estimates of recent recruitment and total density (numbers of individuals/sq meter). Substratum collected by divers will be sent to shore and washed through a screen series and all live mussels removed. Each mussel will be identified and its total shell length measured. At the end of the day all mussels collected from the area to be dredged will be returned to the water unharmed. Mussels taken from the proposed disposal area will be moved to a new location to minimize interference with the mark and recapture study (see below). Sample methods will follow those described by Miller and Payne (1993).

Task II: Minimizing the Effects of Dredging. At least 2 different strategies will be used to dredge the site. The first (Treatment 1) will be to have the dredge operator lightly skim the top 12 inches (30.5 cm) of substratum and carefully place it in the barge, which will have some water in it. The dredged material will be kept moist while loading takes place. The barge will not be filled with material, but will only carry a single layer of sediment (approximately 15 cubic yards (11.5 cubic meters) in a vessel designed to carry 300 cubic yards (229 cubic meters). In the second treatment (Treatment 2) the operator will dredge and load the barge in the same manner as is usually done in a typical operation. A full scoop of dredged material will be taken and the barge will be fully loaded with material.

Mortality associated with action of the clamshell will be assessed for each treatment. This will be accomplished by placing one or more buckets of material (from Treatment 1 and 2) on a flat barge for examination. Live mussels will be removed from the sediment, identified, and total shell length measured. An assessment of mortality will be made by determining if shells of live or recently living or recently killed mussel are 1) scraped, 2) broken or cracked so that tissue is exposed, or 3) obviously killed by the dredge.

In both Treatments 1 and 2, dredged material will be disposed in a thin layer so as not to bury mussels. The dump scow will be positioned perpendicular to shore, then moved offshore in a straight line while releasing material gradually. The line of disposal material will be marked with buoys, flagging on shore, and GPS. Each barge load of material will be placed in a separate site, and individually marked for further study.

Task III. Estimating Impacts. Mussel mortality will be estimated using two procedures. The dive crew will collect mussels from the disposal areas using qualitative and quantitative methods. Sampling will begin as soon as the material has been placed and the area can be worked safely. Sampling techniques will be identical to those used in Task I. Mussels from the quantitative samples will be identified and total shell length measured. Mussels collected using qualitative methods will be identified and counted. In addition to live mussels, divers will retrieve any recently killed or damaged mussels. An assessment of mortality will be made as described above. Live mussels will be marked with an identifying number. At the end of the sampling period, all live mussels will be returned to the area where they were collected (the appropriate disposal area).

The survey will be repeated in approximately 4 weeks, then approximately 12 months (or into November 2003) later. This work will require a total of three field trips, two in FY02 and one in FY03 (possibly FY 04).

An analysis of impacts will be based upon the percentage mortality of mussels transported to the new location. It will be assumed that the disposal site will have either no mussels present before the test, or that the density is extremely low (and measurable from the preliminary work). We will determine the percentage of broken or otherwise physically damaged mussels to assess initial mortality (within the first 24 hours). Subsequent mortality will be assessed principally by a Mark-and-Recapture method using mussels that have been marked and then turned loose (White and Burnham (1999). Recent information on mussel relocations (Dunn and Sietman (1997), Cope and Waller (1995)) will be reviewed.

As an added test to our procedures, we will collect a subset of mussels from an undisturbed area, mark them, and then recapture them after the 1-month and 1-year time interval. This location of the test area will be determined at a later date. The work could be done between miles 194 and 195.

Finally, we will have divers visually examine the area that was dredged. They will conduct timed searches for mussels to assess the efficiency of removal. We will also collect approximately 5-10 quantitative samples (0.25 sq m quadrat) to check for juvenile mussels. This will provide an estimate of the percentage of mussels that can reasonably be removed prior to the final dredging operation.

Task IV: Documentation. A progress report will be submitted within 30 days of each field trip. This will include a description of field tasks and major findings (species list, density, community composition data, etc.) A summary report will be prepared at the end of FY 03 that contains all of the data.

We propose to have Dr. James Sickel, Murray State University, assist with this work. As an outside consultant he could provide an unbiased assessment of experimental design,

field methods, and data interpretation. Dr. Sickel would be present during the field survey, and would coauthor any significant reports or publications.

Schedule

| Item | Approximate Date |
|---|-------------------------|
| Initial Survey | Sept 02 |
| Follow-up Survey (approximately 30 days later): | Oct 02 |
| Progress Report for 2002 Studies | Nov 02 |
| Coordination meeting | Mar-May 03 |
| Final Survey | Sept-Nov 03 |
| Preliminary Report | Dec 03 |
| Final Report | Mar 04 |

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SECTION 404(b)(1) EVALUATION
EXPERIMENTAL MUSSEL RELOCATION
TENNESSEE RIVER MILES 194.0-195.0
HARDIN COUNTY, TENNESSEE
SEPTEMBER 2002

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SECTION 404(b)(1) EVALUATION
EXPERIMENTAL MUSSEL RELOCATION
TENNESSEE RIVER MILES 194.0-195.0
HARDIN COUNTY, TENNESSEE
SEPTEMBER 2002

I. Project Description

A. Location

The action area of the proposed experimental mussel removal and relocation is located between approximate Tennessee River Mile 194.6-194.8, on the left descending bank, in Kentucky Reservoir, Hardin county, Tennessee. The site (Latitude 35⁰, 11', 44", North; Longitude 88⁰, 18', 39", West) is approximately 12 miles downstream of Pickwick Lock and Dam. The proposed experimental area can be located on a U.S. Geological Survey 7.5 Minute Series Quadrangle map labeled 13 NE – Pittsburg Landing.

B. General Description

The removal and relocation sites are referred to as dredge and discharge sites respectively in this evaluation. The proposed work consists of removing approximately 1,000 cubic yards of gravel and sand from a selected dredge site at Tennessee River mile 194.8, within the proposed experimental area. A clamshell dredge and split-hulled dump scow would be used to perform the experiment. The material would be loaded into a dump scow and transported for placement in open-water over a selected discharge site at Tennessee River Mile 194.6, within the experimental area. The clamshell dredge would remove the top 1-foot of substrate that would be placed into a dump scow one layer deep. The dump scow would be moved to the discharge site. The split hull would be carefully opened to disperse the substrate in a 1/2-foot layer over the river bottom. This method would be compared to a second treatment using routine dredging operations. In the second treatment, the clamshell dredge would remove 2-3 feet of substrate to fill the clamshell dredge. The dump scow would be filled to capacity and moved to the discharge site. As in the experimental treatment, the split hull would be carefully opened to disperse the substrate in a 1/2-foot layer over the river bottom. These two treatments would be compared to a diver removal and relocation procedure that would also be used at the discharge site. Commercial mussels are the targeted test organisms in this experiment.

C. Authority and Purpose

The purpose of the experimental mussel relocation is to develop a method for safely removing mussel communities prior to maintenance dredging activities. A safe, efficient, timely, and holistic mussel relocation method is needed because mussel communities are occasionally found at maintenance dredging sites. Maintenance dredging is required to maintain a safe and open authorized navigation channel.

The experimental mussel relocation method is associated with routine maintenance operations and could minimize the effect maintenance dredging and placement activities have on the aquatic resources, of a river system. The Rivers and Harbors Act of July 3, 1930, authorized the permanent improvement of the Tennessee River to a navigable depth of nine feet at low water from the mouth to Knoxville, Tennessee (46 Stat. L. 927-28). Section 4(j) of the Tennessee Valley Authority Act requires the Tennessee Valley Authority to provide a nine-foot channel in the Tennessee River from Knoxville to its mouth. Since passage of the Tennessee Valley Authority Act of 1933 (48 Stat. L. 58-72), later amended on August 31, 1935 (49 Stat. L. 1075-81), U.S. Army, Corps of Engineers responsibilities have been in accordance with navigation laws. These navigation laws place control and supervision of navigable water with the Secretary of the Army, Corps of Engineers.

The Nashville District has statutory responsibility to maintain an open and safe navigation channel along the 652 navigable miles of waterway on the Tennessee River. The Tennessee Valley Authority also views the provision of an open channel, as carrying out part of the Tennessee Valley Authority's statutory mission. The Tennessee Valley Authority is a cooperating agency in this experiment.

Open-channel maintenance necessitates periodic dredging in areas of frequent natural river substrate deposition. A final Environmental Impact Statement (EIS) covering the Nashville District's open-channel maintenance program for the Tennessee River and tributaries was filed with the President's Council on Environmental Quality on March 7, 1976.

D. General Description of Dredged Material

1. General Characteristics of Material

The material at the proposed dredge site consists of loose gravel and sand.

2. Quantity of material

Approximately 1,000 cubic yards of material would be excavated from a total area of approximately ½ acre.

3. Source of Material

The dredge material is the result of natural river deposition.

E. Description Of Proposed Discharge Site

1. Location

A site location map is attached. The proposed discharge site is located approximately 100 meters offshore near Tennessee River Mile 194.6, along the left descending bank in Hardin County, Tennessee. The discharge site nests within a segment of the river (Tennessee River Miles 194.0-195.0) currently permitted for commercial sand and gravel extraction. Some commercial dredging activities have occurred there within the last few years.

2. Size

Approximately 1 acre at the proposed discharge site would be covered with material spread in a layer of approximately 1/2-foot deep.

3. Type of Site

The discharge site is located in open-water.

4. Types of Habitat

A Tennessee Wildlife Resource Agency mussel survey, conducted on May 22, 2002, found that the substrate contained gravel, sand, and some fines. Water depth ranged from 20-30 feet deep. The substrate at the discharge site provides mussel habitat as evidenced by a small community of mussels living at the site. The river bottom contours are furrowed and uneven. The area is permitted for commercial sand and gravel extraction and has been dredged in the recent past.

5. Timing and Duration of Discharge

The proposed activities would be performed over the course of approximately 3-5 days. The work would be scheduled to avoid the fish and mussel spawning season (March-August) and when the water temperature is greater than 60^o F. At this temperature, mussels are mobile enough to extract themselves if they are buried under a thin layer of sediment. September and October are generally the driest months of the year. This time frame would minimize sediment runoff due to heavy rains.

F. Description Of Disposal Method

A hydraulically operated split-hull scow would be used to disperse the dredge material over the discharge site. The hull of the scow would be partially opened to allow the contents to spread out on the river bottom in a thin layer of approximately ½ foot deep. This action minimizes smothering of organisms, and changes to the substrate contours and elevation.

II. Factual Determinations

This evaluation concerns discharge of dredged material below ordinary high water.

A. Physical Substrate Determinations

1. Substrate Elevation and Slope



The substrate river bottom slope at the discharge site is furrowed and uneven. Water depth varies from 20-30 feet. Dredge material will be spread across the river bottom at approximately ½ foot deep. This placement method would result in little change to the current substrate elevation and slope.

2. Sediment Type

The dredged substrate consists of gravel and sand. This material is similar to the material at the discharge site, but the overall grain size of the dredged material is

slightly larger than the grain size at the discharge site, as it contains little silt. The dredged material may have a beneficial effect by providing a slightly improved substrate for mussels.

3. Dredged/Fill Material Movement

The dredged material consists of gravel and sand. The grain size of this substrate is slightly larger than the grain size at the discharge site. Due to the large particle size of the dredge material, and considering the depth of placement, movement of the material as a result of wave or wind action or from water level fluctuation after placement is not expected. The substrate at the discharge site consists of small particles indicating that water velocity is slow enough for small particles to accumulate. Dredged material will be spread across the river bottom at approximately ½ foot deep. This shallow layer would minimize slumpage or movement of the material.

4. Physical Effects on Benthos

Very small mussels and aquatic insects that are buried by a ½ foot layer of dredged material would not likely survive. Large juveniles and adult mussels would be expected to be able to dig their way out to the surface since these larger individuals have been known to migrate through substrate up to a foot deep. The dredged material would be loose and unconsolidated making it easier for mussels to migrate through the material in comparison to existing substrate. The impact would be unavoidable but very localized and small. The dredged material is anticipated to stay in place and expected to provide stable habitat. A benthic community would be expected to re-colonize since the dredged material already contains a commercial mussel community. Natural drift from upstream would add to the community.

5. Other Effects

Noise, vibration, and wake would result from dump scow and towboat activities within the experimental area. These activities could locally infringe on commercial and recreational traffic, fisherman, and citizens living adjacent the river. Fish and other nekton will be disturbed and will temporarily move from the area. These effects are unavoidable but should be of short duration and limited area.

6. Actions Taken to Minimize Impacts

Most fish and other mobile aquatic organisms will flee the area during the removal and relocation activities and diver surveys. All efforts will be made to avoid fish and mussel spawning activities that usually occur between March and August. Work would be planned in early fall during low flow conditions and observed by various agency biologists.

On May 22, 2002, TWRA conducted a mussel survey of the discharge site. A single pink mucket (*Lampsilis abrupta*) was found and relocated out of the experimental area. To minimize the possibility of impacting any other individual

listed mussel, a second mussel survey will be conducted at the dredge and discharge sites. Any listed species found would be hand removed and relocated by divers. Commercial mussels found in the footprint of the discharge site will be hand removed and relocated by divers. This approved method of mussel relocation would be used as the control to compare mussel survivability and well being to the experimental and routine mechanical removal method of mussel relocation. This procedure will reduce impact to large commercial mussels. It also reduces mixing of large individuals from the resident and relocated populations.

Small juvenile mussels missed during these searches would either remain at the dredge site or would be buried at the discharge site. However, to minimize this impact, dredged material would be dispersed slowly to allow for deposition of no more than ½ foot of substrate. The experiment would be conducted when water temperature is expected to reach 60° F. At this temperature, and with minimal burial by dredged material, mussels left in the disposal area have a good chance of digging their way up to the surface of the substrate.

B. Water Circulation, Fluctuation, And Salinity Determinations

1. Water

Kentucky Reservoir maintains a regulated pool to ensure adequate navigation depths. Monitoring on Pickwick Reservoir indicates that the water is of good quality. Overall, the “health” of the aquatic resources in Kentucky Reservoir is good in its headwaters. Kentucky Reservoir is generally well mixed lacking thermal or dissolved oxygen stratification in this segment of the river, which is riverine in character.

a. Salinity

Not applicable. The proposed action would occur in a freshwater system.

b. Water Chemistry

Parameters of physical and chemical quality (Temperature, Specific Conductance, Dissolved Oxygen, hardness, and pH) would not be affected by the work. The dredge material consists of uncontaminated inert cobble, gravel, sand and fines. Any minor effects would quickly dissipate to pre-dredging ranges quickly when the experimental mussel relocation experiment is complete.

c. Clarity

Due to the relatively large particle size of the dredged material, any decrease in clarity would be minor, localized, and would cease quickly once the operation is completed. After the operation is complete there should not be any remaining changes from current conditions.

d. Color

The dredged material will not affect the true color of the water. The material is composed of inert and insoluble cobble, gravel, and coarse sand. Localized

effects on apparent color would be seen; however, these affects would be temporary and localized given the large particle size of the substrate.

e. Odor

The proposed activities would not have any effect on odor. The dredged material consists of inert cobble, gravel, sand, and fines. The substrate contains very little organic matter.

f. Taste

The proposed action should not have any significant effect on taste. The dredged material consists of inert cobble, gravel and sand.

g. Dissolved Gas Levels

The proposed activities will not affect the composition or nature of dissolved gases in the water column. No biological or chemical oxidation demand is expected to occur since the dredge substrate consists of inert material.

h. Nutrients

The proposed activities would have no effect on nutrient concentrations. The dredged material consists of inert sand and gravel.

i. Eutrophication

The proposed action would have no effect on eutrophication. This process does not occur in a fast flowing river.

j. Others as Appropriate

Specific conductance, hardness, and water temperature would not be affected by the work. The dredged material consists of inert and insoluble sand and gravel.

2. Current Patterns and Circulation

The proposed activities would not affect existing current and circulation patterns. The Tennessee River is very large and the amount of material is very small. Spreading the dredge material in a layer of approximately ½ foot deep would prevent any obstruction to circulation.

a. Current Patterns and Flow

The proposed action would not change existing current patterns or flow in the river. The Tennessee River system is very large and there would be no effect on the capacity of the river to flow freely. The dredged material would be deposited in a relatively thin layer and in a relatively narrow zone adjacent the left descending bank of the Tennessee River. The water depth and low profile of the dredge material would not likely affect current patterns.

b. Velocity

Water velocity would not be affected by the proposed experiment. The flow of the Tennessee River is large and regulated.

c. Stratification

Not applicable. The proposed activity is located in a segment of the Tennessee River that is riverine in character precluding stratification.

d. Hydrologic Regime

The proposed activities would not affect the normal fluctuations in the hydrologic regime of the Tennessee River. The proposed activities are insignificant in comparison to the size of the Tennessee River.

3. Normal Water Level Fluctuations

The proposed action would not affect the normal water level fluctuations in the Tennessee River. Water level is controlled by Pickwick Lock and Dam releases upstream.

4. Salinity Gradients

Not applicable. The proposed action would occur in a freshwater system.

5. Actions That Will Be Taken to Minimize Impacts

Based on inspections, all efforts will be made to ensure compliance with State water quality rules and permits. The work would occur during daylight hours and low flow conditions to ensure safety for the crew and river traffic.

C. Suspended Particulates/Turbidity Determinations

The amount of dredge material is very small. Elevated levels of suspended particles would be extremely localized. The dredge material consists of gravel and sand. Given the large particle size, the material is expected to settle out of the water column quickly. On completion of the activities, local turbidity is expected to return to background levels.

1. Expected Changes in Suspended Particulates and Turbidity Levels Vicinity of Disposal Site

Any effect on suspended particles or turbidity is expected to be localized and short-termed. Re-suspended material from dump scow disposal is also expected to settle rapidly. The predominantly large sized sediments to be dredged would not stay in suspension very long. Sampling performed in 1978 upstream and downstream of commercial dredges (which represent greater disturbance than clamshell/dump scow operations) showed that turbidity and suspended solids generally dissipated within 1,000 feet downstream the proposed activities. In other sampling performed on an actual Corps clamshell/dump scow operation in 1971, turbidity and suspended solids returned to near background levels between .05 and 0.4 miles downstream of the site. In perspective, disposal induced turbidity and suspended

solids are an insignificant fraction of levels that occur during ordinary high flows following storm events.

2. Effects on Chemical and Physical Properties of the Water Column

The excavated material is composed of natural gravel and sand found in the river system. Due to particle size contaminants do not adhere to these materials. Excavation should have little or no effect on the chemical or physical properties of the water column. The material is inert.

a. Light Penetration

The temporary increases in suspended sediment load and turbidity would reduce light penetration through the water column. But this affect would be short term and highly localized. The affect would be limited to the duration of the dredging and discharge activity. Once this activity ceases, light penetration would return to normal.

b. Dissolved Oxygen

There would be little or no affect on dissolved oxygen. The dredge material is virtually inert, inorganic material, which would have no affect on biological or chemical oxygen demand.

c. Toxic Metals and Organics

The TVA ecological health rating in 2000 noted that Kentucky Reservoir sediment was free of pesticides and PCBs. Concentrations of metals were within background levels. Additionally, due to the type and particle size of the material, contaminants are not expected to adhere to the particles. The dredged material comes from an area of high-energy currents where particles smaller than fines, move downstream.

d. Pathogens

No pathogens are expected to be released into the water column. The dredge material consists of large particles. Pathogens do not readily adhere to large inert particles.

e. Aesthetics

Turbidity and suspended solids within the vicinity of the dredge and discharge sites would affect the aesthetics of the water column. These affects are local and temporary. On completion of the work, the aesthetics of the water column would be the same as pre-work conditions.

f. Others as Appropriate

The aesthetics of the river view would be temporarily affected at the dredge and discharge sites by the visual appearance of necessary maintenance dredging vessels and equipment. This effect would only last as long as it takes to get the

work completed. On completion of the work, the visual appearance of the dredge and disposal sites would look the same as pre-work conditions.

3. Effects on Biota

No effects related to chemical-biological interaction are anticipated. Primary affects on the biota would be physical. Biota would be dislodged, relocated, or covered, however this affect would be limited and confined to the immediate action area of the activities.

a. Primary Production, Photosynthesis

There could be temporary but localized decreases in primary production and photosynthesis during maintenance dredging and disposal activities because of increases in suspended solids and turbidity. This effect would be short term and minor. In perspective, any disruption to primary production within the experimental area would be insignificant given the size of the Tennessee River system where primary production would continue to occur.

b. Suspension/Filter Feeders

There could be some mortality of suspension or filter feeders during maintenance dredging activities. These organisms could be impacted by the localized increases in suspended solids and turbidity. Any adverse impacts should be temporary and very localized. The proposed action should not have any significant long-term effects.

c. Sight Feeders

Because sight feeders can avoid the immediate area, any adverse impacts should be minor. Impacts would be temporary. Sight feeders would be expected to return when the proposed action was completed.

4. Actions That Would Be Taken to Minimize Impacts

The best operating procedures would be followed to minimize affects. The amount of area disturbed would be limited and localized in comparison to the rest of the Tennessee River system.

D. Contaminant Determinations

Data collected by TVA in 2000 indicated that Kentucky Reservoir sediments were free of pesticides and PCBs. Metal concentrations were within background levels. Due to the type and particle size of the material, contaminants are not expected to adhere to the dredged material.

E. Aquatic Ecosystem And Organism Determinations

1. Effects on Plankton

Minimal affects are possible as a result of brief re-suspension of a fraction of the sediments during dredging and placement. Plankton may be temporarily disturbed

during maintenance dredging activities, however the effects are temporary and localized. There would be no significant long-term affect on plankton. Plankton are ubiquitous and are expected to drift back into the area on completion of the activities.

2. Effects on Benthos

A portion of the benthos will be lost at both the dredge and discharge sites. The dredge material consists of a sediment size expected to provide a better and more productive benthic habitat at the disposal site. Both the dredged and discharge areas are expected to be colonized by a benthic community through natural drift by organisms upstream. The current substrate at the disposal site does not constitute particularly high quality habitat for benthic macroinvertebrates. The dredged material would cover the limited benthos occurring at the placement site. However, the material would provide better substrate for quick re-colonization at the site. Suspended particulate/turbidity impacts on benthic macroinvertebrates downstream of the site would be localized, short-lived, and of shallow depth given the fact that the disposal method would be controlled to disperse the dredged material in an approximate 1/2 foot layer.

3. Effects on Nekton

The proposed action should not have any significant affect. Nekton are mobile and would avoid the sites during maintenance activities, but would return on completion of the work.

4. Effects on Aquatic Food Web

Effects on the aquatic food web would be negligible because of the localized and short-term nature of the impacts. During the dredging and placement activities, benthic organisms would be either damaged or exposed. They would initially provide additional food for fish and birds. After the activities, it will take a short time for the benthic organisms to re-colonize the sites, which will happen quickly due to natural drift from upstream. The size of area affected is very small and the predators, fish and birds, are very mobile and can seek food elsewhere.

5. Effects on Special Aquatic Sites

a. Sanctuaries and Refuges

The proposed activities are not expected to affect sanctuaries or refuges. The closest mussel sanctuary is located approximately 7 miles upstream.

b. Wetlands

No wetlands as defined in 33 CFR 323.2 (c) would be affected by this proposed work. All proposed work is in open water.

c. Mud Flats

There would be no affect. There are no mud flats.

d. Vegetated Shallows

There would be no affect. The activities are confined to open water where there are no vegetated shallows.

e. Coral Reefs

No coral reefs exist. The Tennessee River is a freshwater system.

f. Riffle and Pool Complexes

The Tennessee River is a large deep water system. These features do not exist in this system.

6. Threatened and Endangered Species

All work would occur in open water. These proposed actions have been coordinated through consultation with the U.S. Fish and Wildlife Service and the Tennessee Wildlife Resources Agency. On May 22, 2002, a single listed pink muck (*Lampsilis abrupta*) was located in the disposal site. The Tennessee Wildlife Resources Agency removed and relocated this individual. Another mussel survey of the action area would be conducted prior to the proposed action. Any listed species found would be removed and relocated outside the action area. The rest of the population consists of a small community of commercial mussels.

The Biological Opinion issued by the USFWS on September 9, 2002, concluded that the proposed experimental mussel relocation method was not likely to jeopardize the continued existence of federally listed species nor destroy or adversely modify any critical habitat as no such habitat has been designated.

7. Other Wildlife

There would be no significant effect on other wildlife. Terrestrial animals will be potentially disturbed by the noise and activities. However the proposed actions are localized and temporary. Amphibians and reptiles are mobile enough to avoid the area during the activities. Pre-work conditions are expected to return when the activities are complete.

8. Actions That Would Be Taken to Minimize Adverse Impacts

Best operating procedures would be used to minimize any adverse impacts on the environment. Dredging and discharge of dredge material would be planned to minimize any adverse impacts on the biota.

F. Proposed Disposal Site Determination

All dredge material will be disposed in open water at a pre-selected discharge site.

1. Mixing Zone Determinations.

Suspended sediment and turbidity during the maintenance operations would be localized and short-lived. The effects of maintenance activities have been seen to

dissipate within 300 feet downstream of the site. Sampling of similar operations demonstrates that disposal induced turbidity and suspended solids are an insignificant fraction of levels that occur during ordinary high flows following storm events.

2. Determination of Compliance with Applicable Water Quality Standards.

The project would be in compliance with the State of Tennessee's water quality standards. An Aquatic Resource Alteration Permit (ARAP), which serves as Water Quality Certification, was issued by the State of Tennessee on September 13, 2002.

3. Potential Effects on Human Use Characteristics.

There would be no significant negative effect on recreation, water, fishing, or any other human use characteristics. The proposed action areas are located off shore. Work will be very localized and temporary.

a. Municipal and Private Water Supply.

No water supply intake would be affected by the dredge or discharge activities. The nearest water intake is 2 miles downstream of the dredging and placement sites.

b. Recreational and Commercial Fisheries.

The proposed work would have minor adverse impacts on fishing opportunities for the brief duration of the work. Anglers would likely avoid the work area due to increased traffic and noise levels. Disturbance of the substrate would dislodge benthic organisms that could attract fish feeding in the area. The spawning season will be avoided by performing the work in late summer. Any other impact to the fisheries would be insignificant since fish are mobile enough to avoid the action area.

Commercial mussel harvests could be slightly affected. It is hoped that commercial musselers would not collect test mussels that have been marked for recapture for monitoring purposes. Limiting access to approximately 0.2 miles of the experimental area for mussel harvesting during monitoring activities would be insignificant in view of the large beds of commercial mussels found upstream and downstream the experimental area. If successful, the long-term effect of the experimental mussel relocation could provide a means to cultivate mussel beds elsewhere within the Tennessee River system.

c. Water Related Recreation.

The increased noise, equipment, and personnel working in the area would temporarily hinder recreation. However, recreational river traffic will be able to move adjacent the action area but at a slower speed than normal for safety reasons.

d. Aesthetics.

Suspended solids and turbidity effects would be short-term and localized. As previously stated, dredge and placement induced turbidity is an insignificant fraction of that which occurs during ordinary high flows following storm events. The operation would be visible from homes adjacent the river. However, the effects would be short termed (less than one week).

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, and Similar Preserves.

The proposed actions are not expected to affect any of these areas. The closest historical landmark is Shiloh National Park. It is located approximately 3 miles upstream the action area.

G. Determination Of Cumulative Effects On The Aquatic Ecosystem

The proposed work immediately affects an area of about 1 acre. Given the size of the Tennessee River, the affects would be limited, of short duration, and insignificant size. If the proposed experimental mussel relocation is successful, it could be used at areas in need of maintenance dredging that contain large numbers of freshwater mussels. Approximately 6 percent of the Tennessee River has been affected by maintenance work over the 50 years the navigation channel has been in existence. Not all sites contained significant mussel populations. However, in the past, dredge sites that contained large numbers of commercial mussels were disposed in the back chutes of islands. In many back chute disposal sites, aquatic habitat had been improved as evidenced by significant colonization of mussels.

The proposed experiment is designed to maximize safe mussel removal and to minimize death, injury, or stress associated with handling, transport time, and potential burial at a pre-selected placement sites. It is anticipated that by moving communities and a portion of their current habitat to appropriate placement sites is expected to result in establishing additional mussel beds. This cumulative effect would potentially increase mussel numbers and their associated habitat.

H. Determination Of Secondary Effects On The Aquatic Ecosystem

The secondary, or indirect effects on the aquatic ecosystem resulting from the proposed actions have been noted in previous sections. Secondary effects on the aquatic ecosystem could be potentially beneficial if the long-term effect of the proposed experimental mussel relocation method sustains, or increases the mussel resources. Preserving and potentially expanding mussel communities and their habitat would also benefit listed species since they often reside in the mussel community.

No additional significant secondary effects on the aquatic ecosystem have been identified.

III. Findings Of Compliance Or Non-Compliance With The Restrictions on Discharge

A. Adaptation of The Section 404(B)(1) Guidelines to this Evaluation

No adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

B. Evaluation of Availability Of Practicable Alternatives To The Proposed Discharge Site, Which Would Have Less Adverse Impact

On The Aquatic Ecosystem

There is no feasible alternative to working in the river. The proposed experimental mussel relocation method is designed to relocate significant mussel resources prior to planned maintenance dredging. A No Action would not have a less adverse impact on the aquatic system. As shoaling continues to lessen the width and depth of the navigation channel, barges eventually drag along the bottom, crushing the aquatic community. In the event of barge grounding, emergency measures to free barges could be more devastating to the aquatic community because emergency activities could be immediate and not as accurate or protective of the aquatic system as planned maintenance dredging operations.

C. Compliance With Applicable State Water Quality Standards

Water quality standards set by the State of Tennessee and any special conditions delineated in the state water quality certification or Aquatic Resource Alteration Permit (ARAP) would be followed.

D. Compliance With Toxic Effluent Standard Or Prohibition Under Section 307 Of The Clean Water Act

The dredging operations would not violate Section 307 of the Clean Water Act.

E. Compliance With The Endangered Species Act Of 1973

Coordination and consultation procedures with the U.S. Fish and Wildlife Service have been followed.

F. Compliance With Specified Protection Measures For Marine Sanctuaries Designated By The Marine Protection, Research, And Sanctuaries Act Of 1972

Not applicable. The proposed activities are located outside of these areas.

G. Evaluation of Extent of Degradation of the Waters of the United States

1. Significant Adverse Effects on Human Health and Welfare

The proposed actions would not result in any significant adverse impacts on human health and welfare.

a. Municipal and Private Water Supply

No municipal and private water supplies would be affected by the proposed activities. The nearest water intake is located 2 miles downstream.

b. Recreational and Commercial Fisheries

The discharge of dredged material would not have any long-term adverse affect on the fishery resources. Impacts would be limited to the brief re-suspension of sediment and localized increases in turbidity resulting from placement activities. Mussel harvesting could be affected for up to one year. The experimental procedure will use a mark-and-recapture method to locate individual mussels for monitoring purposes. It would be best if no mussels were removed from the action areas prior to one year. However, the footprint of the proposed experiment covers approximately 0.2-0.3 river miles. This area is insignificant compared to the remaining miles of the Tennessee River open to commercial mussel harvesting.

c. Plankton

The proposed action should not have any significant effects. Plankton are ubiquitous and will drift into the action area unhindered when the work is completed.

d. Fish

The proposed activities would not result in any significant adverse impacts on recreational or commercial fishing. Fish would avoid the area temporarily while the proposed activities are occurring, but they are expected to return on completion of the maintenance work.

e. Shellfish

The experimental mussel relocation method is proposed as a possible procedure to safely remove mussels out of and adjacent to the authorized navigation channel requiring maintenance dredging work. If successful, this method could be used to protect large mussel communities by relocating as many as possible to selected disposal areas. Cultivating new beds would expand the commercial resource. Additionally, any listed species, especially juveniles that are missed during traditional hand removal and relocation by divers, would have a chance to grow within the relocated community. Doing the experiment as planned would kill, injure or dislodge some of the invertebrates at the experimental dredge site. However the long-term benefits are expected to outweigh the short-term, immediate, and highly localized impact resulting from the experimental method. It is expected that mussels and other shellfish with time, will re-colonize the dredge area.

f. Wildlife

The maintenance activities would temporarily affect terrestrial wildlife due to increased noise and human activity associated with the project. However the proposed action should not have any significant long-term affects.

g. Special aquatic sites

The proposed work would not occur within any special aquatic sites.

2. Significant Adverse Impacts on Life Stages of Aquatic Life and Other Wildlife Dependent.

The proposed action would have no significant adverse impacts on life stages of aquatic life and other wildlife dependent on aquatic ecosystems.

3. Significant Adverse Impacts on Aquatic Ecosystem Diversity, Productivity, and Stability

The proposed action would have no significant adverse impacts on aquatic ecosystem diversity, productivity, or stability.

4. Significant Adverse Impacts on Recreational, Aesthetic, and Economic Values

The proposed action would have no significant adverse impacts on recreational, aesthetic, or economic values. The footprint of the experiment covers 0.2-0.3 miles of river. The proposed area is located within an area permitted for commercial sand and gravel extraction. Commercial mussels also live in the study area. Any hindrance to extract commercial sand and gravel, or harvest commercial mussels is minimal considering there are several other places within the Tennessee River that these activities can and do occur.

H. Appropriate And Practicable Steps Taken To Minimize Potential Adverse Impacts Of The Discharge On The Aquatic Ecosystem

The proposed experiment would occur when the water temperature is above 60^o F. At this temperature, mussels are mobile. Also, the dredged material would be disposed in a layer of approximately ½ foot deep on the river bottom. Impacts of the discharge on the aquatic ecosystem would be minimized because with warm water temperatures, mussels would be expected to be mobile enough to migrate through the thin layer of dredged material. This action would minimize burial of the organisms.

I. On The Basis Of The Guidelines, The Proposed Disposal Site (S) For The Discharge Of Dredged Or Fill Material Is

Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

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| Appendix C Aquatic Resources Alteration Permit | C -1 |
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DEPARTMENT OF ENVIRONMENT & CONSERVATION

Division of Water Pollution Control

401 Church Street

7th Floor, L & C Building

Nashville, TN 37243-1534

September 13, 2002

Mr. Steve Eli
Nashville District Corps of Engineers
Tennessee Valley Authority
P. O. Box 1070
Nashville, Tennessee 37202-1070

SUBJECT: §401 Water Quality Certification
Tennessee Aquatic Resource Alteration Permit
Joint Public Notice 02-43
State of Tennessee Application # NRS 02-110

Dear Mr. Eli:

Pursuant to §401 of the Federal Clean Water Act (33 U.S.C. §1341), the State of Tennessee is required to certify whether the activity described below will violate applicable water quality standards. Accordingly, the Division of Water Pollution Control requires reasonable assurance that the activity will not violate provisions of *The Tennessee Water Quality Control Act of 1977* (T.C.A. § 69-3-101 et seq.) or of §§ 301, 302, 303, 306 or 307 of *The Clean Water Act*.

Subject to conformance with approved plans, specifications, and other information submitted in support of the referenced application, the State of Tennessee hereby certifies the proposed activity pursuant to 33 U.S.C. 1341. This shall serve as authorization pursuant to T.C.A. § 69-3-101 et seq.

LOCATION: Tennessee River Miles TRM 195.0 to 194.0, Left Descending Bank, near Crump, Tennessee, Hardin County

DESCRIPTION: The authorized work includes an experimental evaluation of a mussel relocation methodology. The method would dredge approximately 1,000 cubic yards of coarse sand and gravel, including a resident mussel population, for open water discharge located between TRM 195.0 and 194.0 on the left descending bank of the river. The work will be accomplished using a clamshell type dredge equipment and dump scow.

EFFECTIVE DATE: September 13, 2002

EXPIRATION DATE: September 13, 2003

SPECIAL CONDITIONS:

1. The work shall be accomplished in conformance with the approved plans, specifications, data and other information submitted in support of the above application and the limitations, requirements, and conditions set forth herein.
2. **All work shall be carried out in such a manner as will prevent violations of water quality criteria as stated in Rule 1200-4-3-.03 of the Rules of The Tennessee Department of Environment and Conservation.** This includes but is not limited to the prevention of any discharge that causes a condition in which visible solids, bottom deposits, or turbidity impairs the usefulness of waters of the State for any of the uses designated by Rule 1200-4-4. These uses include fish and aquatic life, livestock watering and wildlife, recreation, irrigation, industrial water supply, and domestic water supply.

3. Dredging is prohibited within 100 feet from shoreline and in depths of ten feet or less (based upon water surface elevation at time of dredging).
4. Dredging is prohibited within ½ upstream and ¼ mile downstream of public water intakes.
5. Dredging is prohibited within 200 feet of any ferry crossing or within 500 feet of any bridge pier.
6. Dredging is prohibited within 300 feet of any pipeline, cable crossing, dock, loading or unloading terminal, or other authorized installation or structure, without prior written consent of the owner.
7. Dredging is prohibited in areas of obvious aquatic weed mass.
8. Appropriate steps shall be taken to ensure that petroleum products or other chemical pollutants are prevented from entering waters of the state. All spills must be reported immediately to the appropriate emergency management agency. Measures shall be taken immediately to prevent the pollution of waters of the State, including groundwater.

The State of Tennessee reserves the right to modify or revoke this permit or to seek modification or revocation should the State determine that the activity results in violation of applicable water quality criteria or violation of the Act. Failure to comply with permit terms may result in penalty in accordance with § 69-3-115 of the Act.

An appeal of this action may be made to the Water Quality Control Board. In order to appeal, a petition requesting a hearing before the Board must be filed within 30 days after receipt of the permit action. In such petition, each contention should be stated in numbered paragraphs that describe how the proposed activity would be lawful and the action of the state is inappropriate. The petition must be prepared on 8½" by 11" paper, addressed to the Water Quality Control Board and filed in duplicate at the following address: Paul E. Davis, Director, Division of Water Pollution Control, 6th Floor L & C Annex, 401 Church Street, Nashville, Tennessee 37243-1534. Any hearing would be in accordance with T.C.A. §69-3-110 and 4-5-301 et seq. Questions concerning this certification should be addressed to Mr. Robert Baker at 615-532-0710.

Sincerely,



For Paul E. Davis
Director

cc: Tom Welborn, U.S. Environmental Protection Agency, Atlanta, GA.
Lee Barclay, U.S. Fish & Wildlife Service, Cookeville, TN
Dan Sherry, Tenn. Wildlife Resources Agency, Nashville, TN
Pat Patrick, Water Pollution Control Division, Jackson Environmental Assistance Center

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| Appendix D Public Notice and Responses | D -1 |
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**US Army Corps
of Engineers®**

Nashville District

Public Notice

Public Notice No. 02-43

Date: May 29, 2002

Please address all comments to:
Nashville District Corps of Engineers, Planning Branch
P.O. Box 1070, Nashville, TN 37202-1070

JOINT PUBLIC NOTICE

US ARMY CORPS OF ENGINEERS TENNESSEE VALLEY AUTHORITY AND STATE OF TENNESSEE

SUBJECT: Proposed Mussel Relocation Experiment Between Tennessee River Miles 195.0 to 194.0, Left Descending Bank

TO ALL CONCERNED: In compliance with Section 404 of the Clean Water Act (CWA) PL 92-500, notice is hereby given that the Nashville District Corps of Engineers and the Tennessee Valley Authority propose to discharge dredged material into waters of the United States as described below. Before the work can be performed, certification/ARAP (Aquatic Resource Alteration Permit) must be obtained from the State of Tennessee, Department of Environment and Conservation, Division of Water Pollution Control, pursuant to Section 401(a)(1) of the CWA, that applicable water quality standards will not be violated. By copy of this notice, the Corps of Engineers and the Tennessee Valley Authority hereby apply for the required certification.

LOCATION: Between Miles 195.0 to 194.0, Left Descending Bank, Tennessee River (Kentucky Lake), near Crump, Tennessee, Hardin County, (USGS Pittsburg Landing, 13 NE, 7.5 Minute Series Quadrangle). See Figures 1 and 2.

DESCRIPTION: The Nashville District Corps of Engineers proposes an experimental evaluation of a newly devised methodology for mussel relocation. The proposed work consists of dredging approximately 1,000 cubic yards of coarse sand and gravel, including a resident mussel population, within a commercial sand and gravel permitted area, for open water placement within the same commercial sand and gravel permitted area located between

Tennessee River Miles 195.0 and 194.0 on the left descending bank of the river. The work will be accomplished using clamshell type dredge equipment and dump scow. At least 2 different strategies will be used to dredge a site. The first (treatment 1) will be to have the dredge operator lightly skim the top 12 inches of substratum and carefully place it in the barge, which will have some water in it. The dredged material would be kept wet while loading takes place. The barge will not be filled with material, but will only carry a single layer of sediment (approximately 15 cubic yards in a vessel designed to carry 300 cubic yards). A second treatment will be to have the operator dredge and load the barge in the same manner as is usually done in a typical dredging operation. A full scoop (3 cubic yards) will be taken; the barge will be fully loaded with material.

Regardless of treatment, dredged material will be disposed in a thin layer so as not to bury mussels. The dump scow will be positioned perpendicular to shore, then moved offshore in a straight line while releasing material gradually. The line of disposal material will be marked with buoys, flagging on shore, and GPS. Each barge load of material will be placed in a separate site, and individually marked for further study. Divers would be used to collect information on survival at specific time intervals (hours, weeks, months) after dredging.

This notice serves to scope by the Corps of Engineers in soliciting comments from the public; federal, state and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received by us will be considered to determine whether to perform this work. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, water supply and conservation, economics, aesthetics, wetlands, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, general environmental effects, and in general, the needs and welfare of the people. Comments are also used to determine the overall public interest of the proposed activity. The proposed work will be performed if the District Engineer determines that it would be in the public interest.

An Environmental Assessment (EA) is being prepared to document anticipated impacts of the work. Copies of the EA may be obtained by writing to: U.S. Army Corps of Engineers, Planning Branch, Attention: Ms. Joy Broach, PO Box 1070, Nashville, TN, 37202-1070, or by calling Ms. Broach at (615) 736-7956. This notice also serves as Notice of Availability of the EA for review at the Estes Kefauver Federal Building Room A532, 110 Ninth Avenue South, Nashville, Tennessee. In addition to consideration of other factors of the public interest, the review process will

include application of the guidelines promulgated by the Administrator, Environmental Protection Agency (EPA), under authority of Section 404 (b) (1) of the Clean Water Act (40 CFR Part 230). A copy of the District Engineer's preliminary 404 (b) (1) evaluation is also available for review at the location listed above.

The National Register of Historic Places has been consulted and no properties listed in or eligible for the National Register are known which would be affected by the proposed work. This review constitutes the full extent of cultural resources investigations unless comment to this notice is received documenting that significant sites or properties exist which may be affected by this work, or that adequately documents that a potential exists for the location of significant sites or properties within the permit area. Copies of this notice are being sent to the office of the SHPO and the U.S. Department of the Interior, National Park Service, Interagency Archaeological Services - Atlanta.

Populations of freshwater mussels have been known to inhabit this general stretch of the Tennessee River. Appropriate studies will be undertaken and adjustments in the proposal will be made to insure that the proposed activity will not destroy or endanger any federally-listed threatened or endangered species or their critical habitats, as identified under the Endangered Species Act. This effort will be conducted under informal consultation with the U.S. Fish and Wildlife Service and with the advice of the Tennessee Wildlife Resources Agency.

Other federal, state and local approvals required for the proposed work are as follows:

- a. Tennessee Valley Authority (TVA) approval under Section 26a of the TVA Act.
- b. Water quality certification from the state of Tennessee in accordance with Section 401(a)(1) of the Clean Water Act.

Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing.

Written statements received in this office on or before **June 28, 2002**, will become a part of the record and will be considered in the determination. Any response to this notice should be directed to the Planning Branch, Attention: Ms. Joy Broach, P.O. Box 1070 (PM-P), Nashville, TN 37202-1070, 615) 736-7956.

Figure 1. Vicinity Map. Location of Experimental Site within Tennessee.

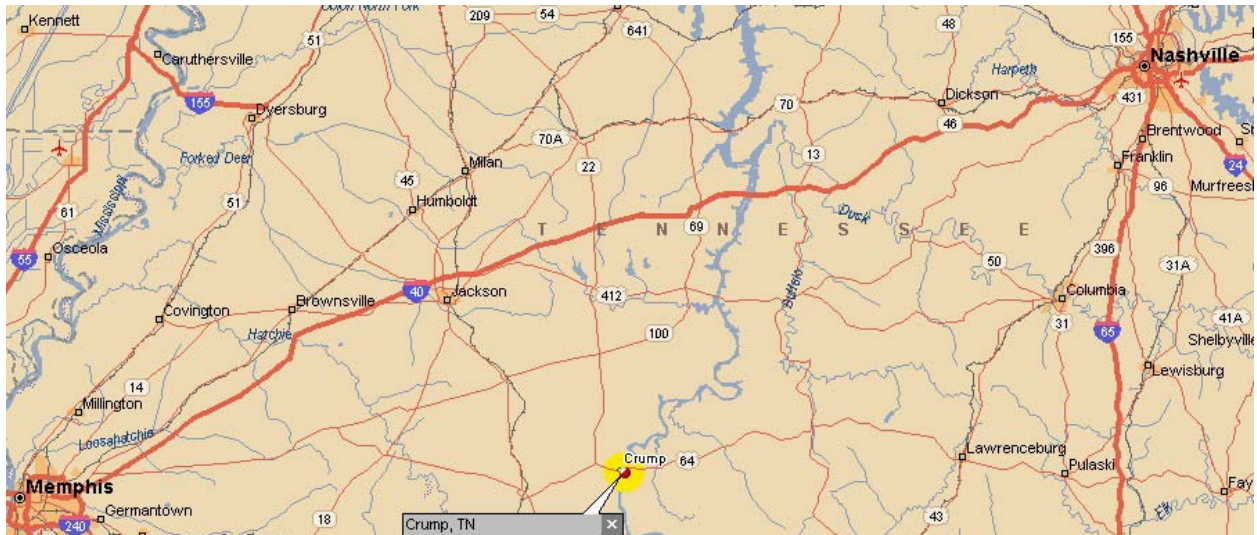
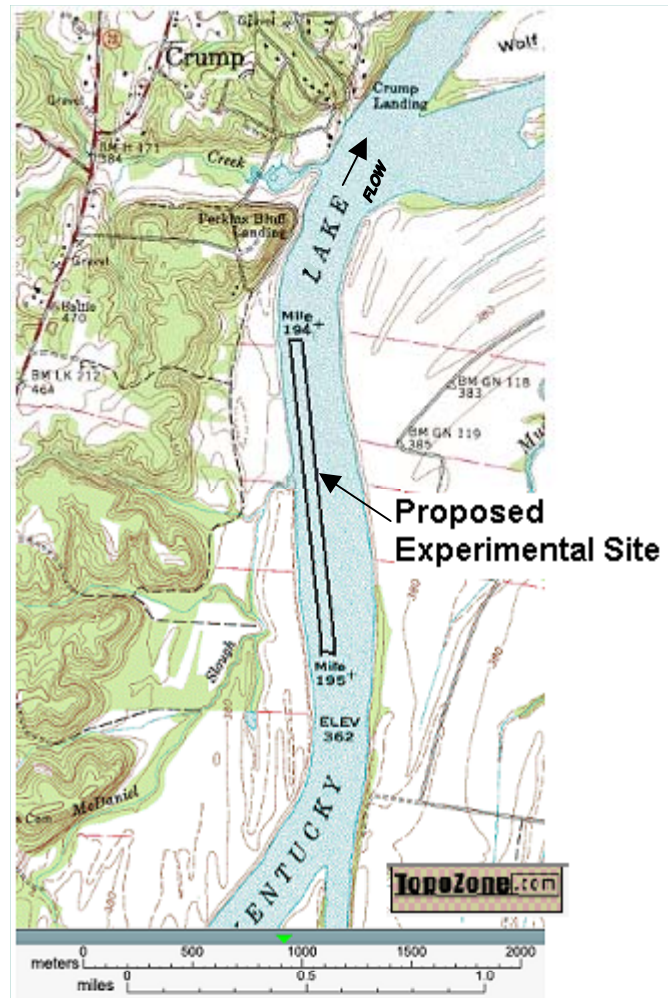


Figure 2. Experimental Site Location just upstream Crump, TN, between Tennessee River Miles 195.0 and 194.0, on the Left Descending Bank. Water depth would be variable depending on pool height and scow displacement.

USGS Topographic 7.5-Minute Series Map: 13 NE
Pittsburg Landing, TENN, 1972



Mr. Gregory M. Denton, PAS Manager
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6th Floor L&C Annex
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Mr. Reggie Reaves
TDEC - Division of Natural Heritage
401 Church Street
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Nashville, TN 37243-0447

Mr. Dan Eagar, NRS Manager
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Mr. David A. McKinney, Chief
Environmental Services Division
TWRA -Ellington Agricultural Center
P.O. Box 40747
Nashville, TN 37204

Regional Director
Tennessee Wildlife Resources Agency
West Tennessee (Region I)
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Herbert L. Harper, Director
Tennessee Historic Commission
Clover Bottom Mansion
2941 Lebanon Road
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Mr. Dodd Galbreath, Director
TDEC – Policy Office
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Mr. Scott Gain, District Chief
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Legislative Office, 35LP
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**Tennessee River Freshwater Pearl Farm
255 Marina Road, I-40, Exit 133
Camden, TN 38320**

From: TNMussels@aol.com

Sent: Tuesday, May 28, 2002 1:17 PM

To: Broach, Joy I; david.mckinney@mail.state.tn.us; James_Widlak@fws.gov

Subject: mussel removal study site

Wed. May 22, 2002 we investigated potential mussel removal and relocation study sites in the vicinity of Diamond Island.

The removal area is located at TRM194.8, 110 meters off the left descending bank, GPS coordinates 35 11.858N, 88 18.695W. This site is characterized by a flat, relatively uniform bottom composed of sand and gravel between a red buoy and the toe of the bank, depth 25ft. near buoy sloping up to 20 ft. near shore. Ten species of mussels totaling 145 individuals (~10 mussels per minute) were collected during a 15 minute timed grab sample, dominant species were *Fusconaia ebena*, *Quadrula metanevra*, and *Q. pustulosa*.

The relocation area is located at TRM194.6, 60 meters off the left descending bank, GPS coordinates 35 12.128N, 88 18.751W. This site is characterized by a variable, bottom composed of gravel near a red buoy, sand and silt near the toe of the bank, depth 25ft. near buoy dropping to 30ft., then sloping up to 20 ft. near shore. Twelve species of mussels totaling 59 individuals (~4 mussels per minute) were collected during a 15 minute timed grab sample, dominant species were *Fusconaia ebena* and *Quadrula metanevra*, **one federal listed species, *Lampsilis abrupta* was collected and removed, off shore underneath the red buoy.** We believe the irregular bottom present at this site affords an opportunity to study the potential for habitat enhancement through development of a more regular bottom contour.

Don Hubbs, Mussel Program Coordinator
Tennessee Wildlife Resources Agency
P.O.B. 70
Camden, Tn 38320
(731) 584-9032
email: Tnmussels@aol.com



TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

June 13, 2002

Ms. Joy Broach
U.S. Army Corps of Engineers, Nashville District
Planning Branch
Post Office Box 1070
Nashville, Tennessee 37202-1070

RE: COE-N, PN# 02-43/MUSSEL RELOCATION, UNINCORPORATED, HARDIN COUNTY

Dear Ms. Broach:

The Tennessee State Historic Preservation Office has reviewed the above-referenced undertaking received on Tuesday, June 11, 2002 for compliance by the participating federal agency or applicant for federal assistance with Section 106 of the National Historic Preservation Act. The Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

After considering the documentation submitted, it is our opinion that there are no National Register of Historic Places listed or eligible properties affected by this undertaking. This determination is made either because of the location, scope and/or nature of the undertaking, and/or because of the size of the area of potential effect; or because no listed or eligible properties exist in the area of potential effect; or because the undertaking will not alter any characteristics of an identified eligible or listed property that qualify the property for listing in the National Register or alter such property's location, setting or use. Therefore, this office has no objections to your proceeding with the project.

If you are applying for federal funds, license or permit, you should submit this letter as evidence of compliance with Section 106 to the appropriate federal agency, which, in turn, should contact this office as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination of eligibility and effect to this office for comment. You may direct questions or comments to Jennifer M. Barnett (615) 741-1588, ext. 17. This office appreciates your cooperation.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jmb



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

June 27, 2002

Ms. Joy Broach
Project Planning Branch
Department of the Army
Nashville District, Corps of Engineers
P.O. Box 1070 (PM-P)
Nashville TN 37202-1070

Subject: Project review; Public Notice No. 02-43, Proposed Mussel Relocation Experiment, Between Tennessee River Miles 195.0 to 194.0 Left descending bank, near Diamond and Wolf Islands, Hardin County TN

Dear Ms. Broach:

Please be advised that a review of our Departmental data bases (Biological Conservation Database) indicates recorded threatened and/or endangered species adjacent to the project location and within a one mile radius of the proposed project site. Our records also indicate additional species occurrence records within an approximate four mile radius of the indicated project site. I have attached our BCD listing for Habitat information for the project area. The Hardin and McNairy County listings are also attached (see **Attachments I and II**). Please note, many of the species records indicated on these listings are aquatic.

The results of our review do not mean that a comprehensive biological survey has been completed. Should you consider a survey of the project sites prior to project implementation, we would appreciate you notifying our office of your findings. Please do not make public the exact location of any element listed here-in, as this could lead to possible over-collection and abuse.

In addition, we offer the following general and specific comments:

General Comments

1. We encourage the development of stream bank restoration and *bioengineering* design as part of the overall project planning. The Department recognizes the importance of stream bank habitat to improving water quality and preventing soil erosion. As you plan the implementation of a project for this area, we would suggest that stream bank, stream side and riparian zones be restored to habitat that is representative of eco-specific communities found within the project area.

General Comments, continued

2. Habitat loss and sedimentation resultant from this large dredging site are of concern, not just locally but also for the potential of long term impacts to the watershed. We recommend that prudent design specifications and dredging strategies be developed to address protection of sensitive ecological sites, particularly mussel populations near the Wolf and Diamond Islands proposed project location.
3. In order to comply with the National Environmental Policy Act consideration should be given to the comprehensive and *cumulative* impacts associated with any relocation actions. Based upon the information provided, it is probable that any proposed in-stream dredging will impact instream, aquatic, habitat and riparian habitat as part of the project.

Specific Comments

1. We request that information on any mussel surveys done as part of the project, be supplied to our Division.
2. We suggest that the mussels collected during the 'skimming' operation (Treatment 1) be examined and typed to species prior to re-deposition.
3. We suggest that divers are provided time to estimate the pre-existing mussel population at the deposition and dredging areas, prior to dumping the dredge material (for both treatments).
4. We are concerned how the COE plans to measure success in this undertaking. Is there monitoring planned for re-colonization areas as well as the dredged areas? Does the project plan to develop tools that will estimate the number of adult mussels excavated during dredging operations?
5. We are unaware of recent mussel population status information specific to this portion of the Tennessee River. Does the project propose to evaluate mussel populations prior to the phased experimental dredging? What is the current impact of dredging on mussel populations?
6. Because mussels maybe stressed during the re-location phase of this experimental project, we suggest the region be reviewed for potential impacts from NPDES discharges near the re-location sites.
7. Please review our comments to Mr. Stephen Eli (February 25, 2002) regarding the proposed dredging and spoil disposal along Wolf Island.

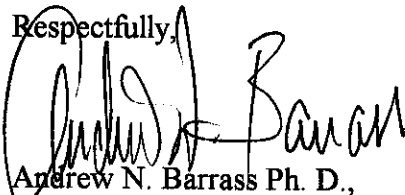
Ms. Broach, U.S. Department of Army, COE-Nashville
Page 3.
June 27, 2002

Specific Comments, continued

8. While we generally support the concept of mussel relocation in order to avoid or minimize impacts from **unavoidable** project actions, we have concerns about potential mussel relocation projects to facilitate otherwise **avoidable** projects. Site-specific consideration should be given to any proposed mussel relocation and relocation should only be proposed as a last resort and only for **unavoidable** projects.

We appreciate the opportunity to assist you with your pre-project planning. If we can be of further assistance with your project please contact our office in Nashville, telephone 615/532-0431.

Respectfully,



Andrew N. Barrass Ph. D.,
Environmental Review Coordinator
Division of Natural Heritage

Attachments: (2) **I. Habitat Listings**
 II. Hardin and McNairy County BCD Listings

cc:
Mr. David Withers, TDEC-DNH
Mr. Robert Baker, TDEC-WPC
Mr. Lee Barclay, Ph. D., U.S. Fish and Wildlife Service
Mr. Dan Sherry, TWRA
Mr. Richard Kirk, TWRA

Attachment I

| |
|--|
| <i>Habitat Information for State and/or Federally Listed Species and Critical or Sensitive Habitat For Locations Within a One Mile Radius of the Project Site and a Fifteen Mile Stream Segment Downstream of the Project</i> |
|--|

The following habitat description(s) has been retrieved from our national data base for the purpose of scientific field review and population determinations. This information also includes data from the TVA BCD.

One mile radius search:

Pink Mucket: [1993, 1998, and 1999, several surveys]

LAMPSILIS ABRUPTA *Found in waters with strong currents, rocky substrates, with depths up to about 1 m. Also found in deeper waters with slower currents and sand and gravel substrates. (Gordon & Layzer, 1989)**

Eastern Fanshell-Pearly Mussel: [1964 and 1998]

CYPROGENIA IRRORATA *Found in sand, gravel, or cobble substrates with moderate to fast currents, and about 1 m deep. (Gordon & Layzer, 1989)**

Crackling Pearly Mussel: [1980]

HEMISTENA LATA *Abundant in sand, gravel, and cobble substrates in swift currents or mud and sand in slower currents. (Gordon & Layzer, 1989)**

Ring Pink: [1978, and 1999]

OBOVARIA RETUSA *Found in riffles and shoals in water not deeper than 1 m, in sand and gravel substrates. (Gordon & Layzer, 1989)**

Orange-Footed Pimpleback: [1978, and 1998]

PLETHOBASUS COOPERIANUS *Found in sand, gravel, and cobble substrates in riffles and shoals with deep water and steady currents. (Gordon & Layzer, 1989)**

Rough Pigtoe: [1982]

PLEUROBEMA PLENUM *Found in sand, gravel, and cobble substrates in shoals. Occasionally found on flats and muddy sand. (Gordon & Layzer, 1989)**

Habitat Information

Page 2.

The snail species listed below currently do not have any special State or Federal protection status. These species and habitat sites are considered significant and are tracked by our Division staff. This information is being provided due to concern for the viability of the species and protection of ecologically sensitive habitat.

Rustic Rocksnail: [1978, and 1979]

LITHASIA SALEBROSA *Found in the tailwater areas of dams. Sometimes found attached to logs. (Conrad, 1834)**

Geniculate River Snail: [1977]

LITHASIA GENICULATA *Occupies rocky substrate in riffle systems, in graded-paved head water streams to medium sized streams. Has been found on bedrock in flowing water below main section of riffles in *Duck River*. **

Varicose Rocksnail: [1978, and 1979]

LITHASIA VERRUCOSA *It inhabits rocky shoals and riffles in moderate current velocities in depths from near the water surface to several feet (approximately 3 ft). **

Onyx Rocksnail: [1978, and 1979]

LEPTOXIS PRAEROSA *Found on algae-covered rocks in strong current (Goodrich & van der Schalie, 1944). **

A Crayfish ?: [1996]

ORCONECTES WRIGHTI ** found in sandy creeks, wetland pools or riparian areas, but in flowing water. **Known from only two sites in Hardin County, TN.

[species occurrence or record date and file or survey information]

Because the habitat for the animal species listed is very specific, you may wish to request further information from Mr. Roger McCoy, in our office in Nashville. He may be reached by telephone at 615/532-0437.

Attachment II

LIST OF RARE AND ENDANGERED SPECIES BY TENNESSEE COUNTY

Hardin and McNairy Counties

02 APR 2002

Hardin County

| SCIENTIFIC NAME | COMMON NAME | FEDERAL STATUS | STATE STATUS | STATE RANK | GLOBAL RANK |
|--------------------------------|----------------------|----------------|--------------|------------|-------------|
| ** ALL PLANTS | | | | | |
| CAREX LACUSTRIS | LAKE-BANK SEDGE | | T | S1 | G5 |
| DIDIPLIS DIANDRA | WATER-PURSLANE | | T | S1 | G5 |
| ERYTHRONIUM ROSTRATUM | BEAKED TROUT-LILY | | S | S2 | G5 |
| HYDRASTIS CANADENSIS | GOLDENSEAL | | S-CE | S3 | G4 |
| IRIS BREVICAULIS | LAMANCE IRIS | | E | S1 | G4 |
| LYSIMACHIA FRASERI | FRASER'S LOOSESTRIFE | | E | S2 | G2 |
| MELANTHIUM VIRGINICUM | VIRGINIA BUNCHFLOWER | | E | S1 | G5 |
| POLYGALA MARIANA | MARYLAND MILKWORT | | S | S1 | G5 |
| SALVIA AZUREA VAR | BLUE SAGE | | S | S2 | G4G5T4? |
| GRANDIFLORA | | | | | |
| SILENE OVATA | OVATE CATCHFLY | | E | S2 | G2G3 |
| ** INVERTEBRATES - MOLLUSC | | | | | |
| CUMBERLANDIA MONODONTA | SPECTACLECASE | | | S2S3 | G2G3 |
| CYPROGENIA IRRORATA | EASTERN FANSHELL | LE | E | S1 | G1 |
| | PEARLY MUSSEL | | | | |
| HEMISTENA LATA | CRACKING | LE | E | S1 | G1 |
| | PEARLYMUSSEL | | | | |
| LAMPSILIS ABRUPTA | PINK MUCKET | LE | E | S2 | G2 |
| LEPTOXIS PRAEROSA | ONYX ROCKSNAIL | | | S3 | G5 |
| LITHASIA GENICULATA | ORNATE ROCKSNAIL | | | S2 | G3G4 |
| LITHASIA SALEBROSA | RUSTIC ROCKSNAIL | | | S1 | G3G4 |
| LITHASIA VERRUCOSA | VARICOSE ROCKSNAIL | | | S3 | G3G4 |
| OBOVARIA RETUSA | RING PINK | LE | E | S1 | G1 |
| PLETHOBASUS CICATRICOSUS | WHITE WARTYBACK | LE | E | S1 | G1 |
| PLETHOBASUS COOPERIANUS | ORANGE-FOOT | LE | E | S1 | G1 |
| | PIMPLEBACK | | | | |
| PLEUROBEMA CLAVA | CLUBSHELL | LE | E | SH | G2 |
| PLEUROBEMA PLENUM | ROUGH PIGTOE | LE | E | S1 | G1 |
| QUADRULA CYLINDRICA | RABBITSFOOT | | | S3 | G3T3 |
| CYLINDRICA | | | | | |
| ** INVERTEBRATES - INSECTS | | | | | |
| OPHIOGOMPHUS ACUMINATUS | TENNESSEE SNAKETAIL | | | S2 | G3 |
| ** INVERTEBRATES - CRUSTACEANS | | | | | |
| ORCONECTES WRIGHTI | A CRAYFISH | MC | E | S1 | G1 |
| ** Other types | | | | | |
| HERON ROOKERY | HERON ROOKERY | | | | |

McNairy and Hardin Counties**Hardin County cont.**

| SCIENTIFIC NAME | COMMON NAME | FEDERAL STATUS | STATE STATUS | STATE RANK | GLOBAL RANK |
|-----------------------------|---------------------------|-------------------|-----------------|---------------|----------------|
| ** VERTEBRATES - BIRDS | | | | | |
| CHONDESTES GRAMMACUS | LARK SPARROW | | T | S1B | G5 |
| EGRETTA CAERULEA | LITTLE BLUE HERON | | D | S2BS3N | G5 |
| HALIAEETUS LEUCOCEPHALUS | BALD EAGLE | LT | D | S3 | G4 |
| LIMNOTHLYPIS SWAINSONII | SWAINSON'S WARBLER | MC | D | S3 | G4 |
| THRYOMANES BEWICKII | BEWICK'S WREN | MC | E | S1 | G5 |
| ** VERTEBRATES - MAMMALS | | | | | |
| SOREX LONGIROSTRIS | SOUTHEASTERN SHREW | | D | S4 | G5 |
| ZAPUS HUDSONIUS | MEADOW JUMPING MOUSE | (PS) | D | S4 | G5 |
| ** VERTEBRATES - REPTILES | | | | | |
| SISTRURUS MILIARIUS | WESTERN PIGMY | | T | S2S3 | G5T5 |
| STRECKERI | RATTLESNAKE | | | | |
| ** VERTEBRATES - AMPHIBIANS | | | | | |
| CRYPTOBRANCHUS | HELLBENDER | MC | D | S3 | G4 |
| ALLEGANIENSIS | | | | | |
| ** VERTEBRATES - FISH | | | | | |
| CARPIODES VELIFER | HIGHFIN CARPSUCKER | | D | S2S3 | G4G5 |
| CYCLEPTUS ELONGATUS | BLUE SUCKER | MC | T | S2 | G3G4 |
| ETHEOSTOMA TUSCUMBIA | TUSCUMBIA DARTER | MC | D | SX | G2 |
| HEMITREMIA FLAMMEA | FLAME CHUB | MC | D | S3 | G3 |
| ICHTHYOMYZON GAGEI | SOUTHERN BROOK LAMPREY | | D | S1 | G5 |
| NOTURUS SP 3 | SADDLED MADTOM | | T | S2 | G2Q |
| TYPHLICHTHYS SUBTERRANEUS | SOUTHERN CAVEFISH | MC | D | S3 | G4 |

McNairy County

| SCIENTIFIC NAME | COMMON NAME | FEDERAL STATUS | STATE STATUS | STATE RANK | GLOBAL RANK |
|--------------------------------|---------------------------|-------------------|-----------------|---------------|----------------|
| ** ALL PLANTS | | | | | |
| ASTER ERICOIDES | WHITE HEATH ASTER | | T | S1 | G5 |
| CYPERUS PLUKENETII | PLUKENET'S GALINGALE | | S | S1 | G5 |
| DROSER A CAPILLARIS | PINK SUNDEW | | T | S1 | G5 |
| ELEOCHARIS TORTILIS | TWISTED SPIKE-RUSH | | S | S1 | G5 |
| MAGNOLIA VIRGINIANA | SWEETBAY MAGNOLIA | | T | S2 | G5 |
| PANAX QUINQUEFOLIUS | AMERICAN GINSENG | | S-CE | S3S4 | G3G4 |
| PLANTAGO CORDATA | HEART-LEAVED PLANTAIN | | E | S1 | G4 |
| PLATANThERA FLAVA VAR FLAVA | SOUTHERN REIN-ORCHID | | S | S2S3 | G4T4?Q |
| POLYGALA MARIANA | MARYLAND MILKWORT | | S | S1 | G5 |
| POLYTAENIA NUTTALLII | PRAIRIE PARSLEY | | T | S1 | G5 |
| SILENE OVATA | OVATE CATCHFLY | | E | S2 | G2G3 |
| STYLISMA HUMISTRATA | SOUTHERN MORNING-GLORY | | T | S1 | G4G5 |

McNairy and Hardin Counties

McNairy County cont.

| SCIENTIFIC NAME | COMMON NAME | FEDERAL STATUS | STATE STATUS | STATE RANK | GLOBAL RANK |
|-----------------------------|------------------------------|-------------------|-----------------|---------------|----------------|
| ** VERTEBRATES - BIRDS | | | | | |
| AIMOPHILA AESTIVALIS | BACHMAN'S SPARROW | MC | E | S2 | G3 |
| ANHINGA ANHINGA | ANHINGA | | D | S1B | G5 |
| BUTEO LINEATUS | RED-SHOULDERED HAWK | | | S4B | G5 |
| CHONDESTES GRAMMACUS | LARK SPARROW | | T | S1B | G5 |
| LIMNOTHLYPIS SWAINSONII | SWAINSON'S WARBLER | MC | D | S3 | G4 |
| THRYOMANES BEWICKII | BEWICK'S WREN | MC | E | S1 | G5 |
| ** VERTEBRATES - MAMMALS | | | | | |
| SOREX LONGIROSTRIS | SOUTHEASTERN SHREW | | D | S4 | G5 |
| ** VERTEBRATES - REPTILES | | | | | |
| MACROCLEMYS TEMMINCKII | ALLIGATOR SNAPPING TURTLE | MC | D | S2S3 | G3G4 |
| OPHISAURUS ATTENUATUS | EASTERN SLENDER | | D | S3 | G5T5 |
| LONGICAUDUS | GLASS LIZARD | | | | |
| SISTRURUS MILIARIUS | WESTERN PIGMY | | T | S2S3 | G5T5 |
| STRECKERI | RATTLESNAKE | | | | |
| ** VERTEBRATES - AMPHIBIANS | | | | | |
| HYLA GRATIOSA | BARKING TREEFROG | | D | S3 | G5 |
| ** VERTEBRATES - FISH | | | | | |
| AMMOCRYPTA BEANI | NAKED SAND DARTER | | D | S2 | G5 |
| AMMOCRYPTA VIVAX | SCALY SAND DARTER | | D | S2 | G5 |
| ETHEOSTOMA PYRRHOGASTER | FIREBELLY DARTER | MC | D | S2 | G2 |
| NOTURUS STIGMOSUS | NORTHERN MADTOM | MC | D | S3 | G3 |

Note: Should the project require further environmental program permits from our Department, please attach a complete copy of this review or assessment to the permit application.



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202-1070

IN REPLY REFER TO

August 27, 2002

Project Planning Branch

Andrew N. Barrass, Ph. D.
Environmental Review Coordinator
Tennessee Division of Natural Heritage
401 Church Street, 14th Floor, L&C Tower
Nashville, TN 37243-0447

Dear Dr. Barrass:

Thank you for your June 27, 2002 response, to Mrs. Joy Broach of my staff regarding the proposed mussel relocation experiment in Hardin County, Tennessee. We appreciate notification of the concerns of the Tennessee Division of Natural Heritage.

The U.S. Army Corps of Engineers, Nashville District and the Tennessee Valley Authority have proposed to conduct the experiment to determine if a clamshell dredge could be used to relocate native freshwater mussels from areas where channel maintenance dredging is required. A joint Public Notice (No. 02-43) concerning this project was released on May 29, 2002. We are finalizing an Environmental Assessment on this project to comply with requirements of the National Environmental Policy Act and associated implementing regulations.

Your Division's concerns regarding State and Federal threatened and endangered species are well heeded. The Corps and TVA have been continuously coordinating with the Tennessee Wildlife Resources Agency and the U.S. Fish and Wildlife Service to address imperiled aquatic resources and their associated habitat. We are currently in formal consultation with the U.S. Fish and Wildlife Service to address the incidental take of at least one endangered mussel species.

Responses to your general and specific comments are addressed in this letter or by supporting documentation attached to the letter.

General Comments 1-3:

1. The Nashville District is committed to environmental stewardship and where applicable, incorporates stream bank restoration and bioengineering into its projects. However, all activities regarding this proposed project are confined to open water well away from the stream bank.

2. The attached proposal documents experimental dredging and placement strategies designed to protect the aquatic substrate and resident mussel population by keeping them relatively intact and minimizing burial at a relocation site. The purpose of the experimental method is to develop dredging strategies that would be protective of aquatic resources. The proposed experimental sites are located a mile or more from mussel populations located near Wolf or Diamond Island, therefore, it is anticipated that these populations will not be affected by the proposed activities.

3. An Environmental Assessment in accordance with NEPA has been prepared. A copy of this report will be mailed to you once consultation with the U.S. Fish and Wildlife Service is complete. It includes discussion of cumulative impacts associated with maintenance dredging and placement activities. This section also includes anticipated outcomes should this method of mussel relocation become an accepted method of mussel removal.

Specific Comments:

Information addressing specific comments 1-5 can be found in the attached proposal: An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging. Dr. Andrew C. Miller of the Engineer Research and Development Center - Waterways Experiment Station, developed this proposal. It was refined with input from The Tennessee Valley Authority, Tennessee Wildlife Resources Agency and the U.S. Fish and Wildlife Service. Survey methods, sample processing, acute and chronic effect measurements are described within this document.

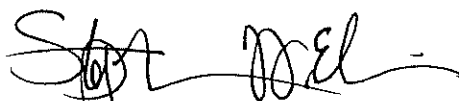
Specific comment 6 requests review of potential impacts from discharges near the relocation site. The proposed dredge and relocation sites are about 0.2 miles apart within the same river reach. Due to this proximity, it is anticipated that the effects from discharges upstream would be the same at both sites.

Specific comment 7 has been addressed in the paragraphs under General Comments since the response to a Scoping letter regarding proposed maintenance dredging contained similar language.

We agree with specific comment 8 that endangered mussel relocation should be used only as a means to avoid or minimize impacts from unavoidable project actions. Maintenance dredging is an unavoidable action necessary to maintain the navigation channel. Thus, it is often not possible to avoid significant mussel resources that in rare instances may reside at maintenance dredging sites. Site-specific consideration will continue to be given to maintenance dredging requirements, and endangered mussel relocation will only be used as a last resort for unavoidable work.

Please feel free to contact Ms. Joy Broach (at 615/736-7956) or Ms. Patty Coffey (615/736-7865) if your review of the attached experimental proposal identifies other concerns that should be addressed. Your input into this project is appreciated.

Sincerely,

A handwritten signature in dark ink, appearing to read 'S. W. Eli', with a stylized flourish at the end.

Stephen W. Eli, P.E.
Chief, Project Planning Branch

Enclosure



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202-1070

IN REPLY REFER TO

JUN 11 2002

Project Planning Branch

Mr. Jim Widlak, Fish and Wildlife Biologist
Ecological Services
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501

Dear Mr. Widlak:

The U.S. Army Corps of Engineers-Nashville District, and the Tennessee Valley Authority would like to request guidance under Section 7 of the Endangered Species Act, from the U.S. Fish and Wildlife Service. We are proposing a mussel relocation experiment and open-water placement on the Tennessee River, left descending bank between Miles 194.6 and 194.8, in Hardin County, Tennessee. The proposal: An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging is attached. Public Notice No. 02-43 (also attached) was issued on May 29, 2002, regarding the proposed mussel relocation experiment and the location of the proposed experimental area.

The Corps of Engineers, with the Tennessee Valley Authority as a cooperating agency, is preparing an Environmental Assessment (EA) to address the potential environmental of the proposed mussel relocation experiment and open-water placement. The alternative No Action will also be considered. This document will be prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's (CEQ) regulations published at 40 CFR Part 1500, and Engineer Regulation 200-2-2 *Procedures for Implementing NEPA*.

The proposed experimental area nests within an area permitted for commercial sand and gravel dredging (Tennessee River Miles 194.0-195.0, Left Descending Bank Only) under a Department of the Army Permit issued to Ingram Materials Company with an expiration date of January 2, 2007. Tennessee State 401 Water Quality Certification (Tennessee Aquatic Resource Alteration Permit - State of Tennessee Application # NRS 01.088) was also granted for this permitted area on January 2, 2002, with an expiration date of January 2, 2007.

In June, 1990, the following Environmental Assessment was completed: Environmental Assessment - Requested Renewal of DA Permits for Commercial Sand and Gravel Dredging on the French Broad And Tennessee Rivers - Alabama and Tennessee. Section C. *Issuance of Permits with Modifications; Part 4. Endangered Species* noted that "Environmentally sensitive areas in the Tennessee River had been eliminated from the modified permit proposal such that occurrence of endangered species or essential habitat in the requested areas is unlikely." At that time, endangered species between Tennessee River Miles 194.0 and 195.0 were not known to occur. However, the 1990 Environmental Assessment also noted, "Should new evidence to the contrary be uncovered...with a potential impact on endangered species..." avoidance or consultation under the Endangered Species Act would be the appropriate action.

On Wednesday, May 22, 2002, Don Hubbs, Mussel Program Coordinator, Tennessee Wildlife Resources Agency, conducted a mussel survey in the proposed experimental area (Email Attached). Mr. Hubbs searched both the proposed experimental mussel removal area (Tennessee River Mile 194.8) and the proposed experimental mussel placement area (Tennessee River Mile 194.6). Mr. Hubbs found one federally listed species, a pink mucket (*Lampsilis abrupta*), which he removed from the proposed experimental mussel placement area.

It is important to note that this proposal: An Evaluation of Methods to Safely Remove Freshwater Mussels Prior to Maintenance Dredging, in addition to other activities and considerations, includes controls to promote the well-being of the mussel resources that currently exist in this segment of the river. Please consider the following:
The activities within the footprint of the proposed removal and relocation study sites would each be contained within an area of one-half acre or less.

The anticipated volume of substrate to be removed is around 1,000 cubic yards.

The substrate consists of loose sand and gravel.

Mr. Don Hubbs, Mussel Program Coordinator, Tennessee Wildlife Resources Agency, conducted a mussel survey in the footprints of the proposed removal and relocation study area. Mr. Hubbs found and relocated one *Lampsilis abrupta* from the proposed relocation study site. Mr. Hubbs was unable to find a suitable site that is devoid of mussels.

The Corps of Engineers would also employ divers to conduct a second survey during preliminary evaluation of the experimental areas prior to any action. Divers will collect qualitative and quantitative samples for freshwater mussels from the removal and the placement area.

The Corps would search and relocate mussels found within the footprint of the proposed placement site at Tennessee River Mile 194.6. This action would ensure continued health of those resident mussels including the continued well-being of listed species should any other individuals be encountered. Additionally, survival of mussels actually dredged from the removal site, and dispersed in the placement site, could be more accurately portrayed and monitored because they would not be mixed in with the resident population.

Regardless of experimental treatment, placement of dredged material would be released in a thin layer of approximately six inches deep, over the proposed experimental relocation site.

Literature reviews have found that mussels naturally migrate up and down within the substrate. Many have been found buried up to a foot deep. Overlaying the experimental relocation site substrate with six inches of material would allow mussels to easily extract themselves should they migrate to the surface of the substrate. Thus any endangered mussels that are not removed from the relocation site would have an excellent chance of survival.

As indicated by the list above, many precautions will be taken during this proposed experiment to adequately ensure the

health, survival, and adequate monitoring of the mussel resources affected by the proposed project. In summary, given the actions in progress, and planned to safeguard the mussel resources, and given the small volume of material and small footprint areas within both the proposed removal and relocation areas, we believe that the proposed project is not likely to affect the continued existence of any State or Federally listed species.

The point of contact is Ms. Joy Broach (615 736- 7956). Feel free to discuss any questions or concerns with her. Thanks for your cooperation with this important experiment.

Sincerely,

A handwritten signature in black ink, appearing to read "Patty Coffey", is written over the typed name of Stephen W. Eli.

60 Stephen W. Eli, P.E.
Chief, Project Planning Branch

Enclosures



United States Department of the Interior

FISH AND WILDLIFE SERVICE

446 Neal Street
Cookeville, TN 38501

June 26, 2002

Lieutenant Colonel Steven Gay
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1070
Nashville, Tennessee 37202-1070

Attention: Ms. Joy Broach, Planning Branch

Re: FWS #02-1906

Dear Colonel Gay:

This is in response to Public Notice 02-43, dated May 29, 2002, concerning a proposed freshwater mussel relocation experiment to be conducted in the Tennessee River between River Miles 194.0 and 195.0 on the left descending bank in Hardin County, Tennessee. Fish and Wildlife Service biologists have reviewed the information submitted and we offer the following comments.

Freshwater mussels are one of the most imperiled faunal groups in North America. At present, 63 species are federally listed as endangered, eight are listed as threatened, seven are candidates for listing, and 14 species are of management concern. The majority of mussel species inhabit riffle and shoal areas in the rivers. These habitats consist of stable, mixed substrate of sand, gravel, and cobble; and moderate to swift river flows that sweep the substrate clean of sediment and provide high oxygen content. Mussel species in the mainstem of the Tennessee River have been significantly affected by impoundment of the river, navigation, associated activities such as dredging to maintain the navigation channel, commercial sand and gravel dredging, and disposal of dredged material.

The Tennessee River historically supported almost 100 species of freshwater mussels. Approximately 50 species still exist in the mainstem of the river, seven of which are federally listed as endangered species. In the action area, two listed species--the pink mucket pearly mussel (*Lampsilis abrupta*) and orangefoot pimpleback (*Plethobasus cooperianus*)--have been recently collected. The following additional federally listed species have been reported from the action area and may still exist in low numbers:

White wartyback - *Plethobasus cicatricosus*
Ring pink - *Obovaria retusa*
Rough pigtoe - *Pleurobema plenum*
Fanshell - *Cyprogenia stegaria*
Cracking pearly mussel - *Hemistena lata*

At the present time, whenever dredging is proposed in an area known to support federally listed species, we recommend that biologists with knowledge and experience in conducting mussel surveys search the proposed dredge area and manually remove as many mussels as possible. The mussels should then be relocated to approved, pre-selected areas and manually placed into the substrate. Intensive searches required to remove mussels from large areas containing suitable habitat can be time-consuming and costly. Relocated mussels likely undergo significant stress during this process and can suffer significant mortality.

The proposed action involves utilizing an accepted method of dredging to evaluate its effectiveness in relocating freshwater mussels. A clamshell dredge will be used to remove the top 12 inches of substrate and mussels, and carefully place the material into a dump scow. Approximately 15 cubic yards of material will be placed in the scow. A second treatment will consist of similar dredging, but the scow will be filled to capacity (i.e., 300 cubic yards). Disposal will be accomplished at separate sites by positioning the scow perpendicular to the riverbank and slowly backing away while gradually releasing the dredged material in a thin layer. Disposal areas will be marked with buoys, flagging on the riverbank, and GPS. Divers will monitor the disposal sites to collect data on survival of the mussels.

The area proposed for the dredging evaluation is in a reach of the Tennessee River known to support mussel populations. During a survey of the area, a single pink mucket pearly mussel was collected and relocated.

We believe that the proposed experiment will provide valuable data regarding the effects of dredging on freshwater mussels. This data will be helpful in assisting Service biologists reviewing future dredging activities. However, in order to adequately evaluate the effects of relocating the mussels in the manner proposed, we believe that long-term monitoring is needed to evaluate survival and recruitment. We therefore recommend that the disposal areas be monitored for at least five years. One objective of the proposed study is to evaluate the effectiveness of light touch dredging as opposed to hand picking to remove mussels from areas to be dredged. However, there is no indication in the public notice that a post-dredging evaluation will be done to determine if the dredging successfully removed all or the majority of the mussels from the dredged area. We recommend that such an evaluation be conducted after dredging has been completed. Additionally, because a federally listed species was found in the action area, we recommend that the Corps of Engineers initiate formal consultation as provided for in section 7 of the Endangered Species Act. The proposed action should not be initiated until our biological opinion is issued.

Thank you for the opportunity to comment on this action. If you have any questions, please contact Jim Widlak of my staff at 931/528-6481, ext. 202.

Sincerely,

A handwritten signature in black ink, appearing to read "Lee A. Barclay". The signature is fluid and cursive, with the first name "Lee" and last name "Barclay" clearly distinguishable.

Lee A. Barclay, Ph.D.
Field Supervisor



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202-1070

JUL 24 2002

IN REPLY REFER TO

Project Planning Branch

Dr. Lee A. Barclay, Supervisor
Ecological Services
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501

Dear Dr. Barclay:

The U.S. Army Corps of Engineers - Nashville District (USACE), and the Tennessee Valley Authority (TVA) have proposed to conduct an experiment to determine if a clamshell dredge can be used to relocate native freshwater mussels from areas where channel maintenance dredging is required. We issued a joint Public Notice (No. 02-43) concerning this project on May 29, 2002 and are preparing an Environmental Assessment on this project to comply with requirements of the National Environmental Policy Act and associated implementing regulations. We also provided more details of the proposed work in a letter to Jim Widlak on your staff dated June 11, 2002. Your response concerning this proposal, in a letter dated June 26, 2002, included some questions about the project and indicated that formal Endangered Species Act consultation would be required, in part to address the incidental take of at least one endangered mussel species. With this letter, USACE and TVA request to initiate formal consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act concerning this project. Information presented in Public Notice 02-43, our previous correspondence, the most current draft of the project proposal (enclosed), and the remainder of this letter support this request.

Your June 26 letter acknowledged the potential benefit of evaluating this possible way of relocating native mussels but identified two areas of concern. One of those concerns related to monitoring the short-term and long-term effects on the relocated mussels. As indicated in Approach Sections I, II, and III in the attached proposal, the monitoring components of the project now include more obvious focus on both short-term and longer-term activities. Immediate effects of the removal technique would be determined by examining some dredge scoops on a work barge as they were being taken off the bottom. Survival in each Treatment plot

and a control plot would be monitored soon after the material had been placed, after approximately 4 weeks, and approximately 12 months after the mussels had been moved. The 4- and 12- month survival monitoring would use mark-and-recapture procedures. Other information about long-term effects would be determined by examining the survival of small mussels and gravid condition of adult female mussels during the 4-month and 12-month monitoring visits.

The other area of concern referred to the percentage of live mussels that might remain when just the top foot of substrate was removed. As noted in Approach Section III, this subject would be addressed by conducting a post-removal survey for mussels in the dredged area. That survey would be conducted using the same qualitative and quantitative approach as described in Approach Task I.

Please feel free to contact Ms. Joy Broach (at 615/736-7956) or Ms. Patty Coffey (615/736-7865) if your review of the experimental proposal identifies other concerns that should be addressed before that document is finalized. Our intention is for the final procedures to be followed during this experiment and the criteria to be used during the evaluation of its results to be determined during meetings with representatives from the various participating agencies (USACE, TVA, U.S. Fish and Wildlife Service, Tennessee Wildlife Resources Agency, and Tennessee Department of Environment and Conservation). We believe that adoption of these procedures would result in a useful evaluation of the dredge removal technique and would reduce the potential effects on endangered mussel species to an insignificant level.

Sincerely,

Vectore V. Wasmley

for Stephen W. Eli, P.E.
Chief, Project Planning Branch

Enclosure



United States Department of the Interior

FISH AND WILDLIFE SERVICE

446 Neal Street
Cookeville, TN 38501

September 9, 2002

Colonel Steven W. Gay
District Engineer
U.S. Army Corps of Engineers
P.O. Box 1070
Nashville, Tennessee 37214

Attention: Mr. Stephen W. Eli, P.E., Chief, Project Planning Branch

Re: FWS #02-1906

Dear Colonel Gay:

INTRODUCTION

Fish and Wildlife Service biologists have reviewed the assessment and project analysis for the proposed mussel relocation experiment in the Tennessee River near Diamond Island, Hardin County, Tennessee. Your July 24, 2002, request for formal consultation was received on July 26, 2002. This document represents our biological opinion on the effects of that action on the federally endangered pink mucket pearly mussel (*Lampsilis abrupta*) and orange-foot pimpleback (*Plethobasus cooperianus*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.).

In addition, although they are extremely rare, it is possible that other endangered mussel species may also occur in the project impact area. Consequently, there is a potential for effect, and this biological opinion will address the following additional listed species:

- White wartyback pearly mussel - *Plethobasus cicatricosus* (E)
- Rough pigtoe pearly mussel - *Pleurobema plenum* (E)
- Ring pink - *Obovaria retusa* (E)
- Fanshell - *Cyprogenia stegaria* (E)
- Cracking pearly mussel - *Hemistena lata* (E)

- Consultation History

This biological opinion is based on information provided in your July 2002 project analysis. Additional information and discussion of the proposed action was provided during an April 29, 2002, meeting in Nashville. The meeting was attended by representatives from the Nashville District Corps of Engineers, Tennessee Wildlife Resources Agency, Tennessee Valley Authority, Corps of Engineers' Waterways Experiment Station, and the Fish and Wildlife Service. A complete administrative record of this consultation is on file in the Cookeville Field Office, 446 Neal Street, Cookeville, Tennessee 38501; telephone 931/528-6481.

BIOLOGICAL OPINION

- Project Description

In order to maintain navigation on the Tennessee River, periodic dredging is required to keep the navigation channel at a minimum depth of nine feet to accommodate barge traffic. Certain areas in the rivers require maintenance dredging at regular intervals to clear the channel of accumulated sand and gravel; other areas may remain open for years before being dredged.

Typical maintenance dredging employs a three-cubic-yard bucket dredge to remove accumulated substrate from the navigation channel. Dredged material is brought to the surface and emptied into a 300-cubic yard, split hull barge, which is then moved to a pre-determined disposal area. If dredging and/or disposal is proposed in areas known to contain federally listed mussels or in areas containing high density mussel beds, Service biologists recommend that divers remove as many of the mussels as possible prior to dredging or disposal and relocate them to suitable habitats upriver or downriver. Such relocation efforts, depending on the size of the area to be dredged and numbers of mussels present, can potentially be time and labor intensive.

The proposed action is an experiment to determine if alternative methods are feasible for removing and relocating freshwater mussels from areas requiring maintenance dredging. The best method currently known for accomplishing such relocations is hand removal of mussels from dredge areas and hand placement in the relocation area by divers. In lieu of divers, the proposed experiment will employ a modified dredging operation to remove mussels and relocate them.

The proposed experiment will be conducted downriver from Diamond Island, between Tennessee River Miles 194 and 195. The proposed dredge site was selected because it is located within a disturbed river reach that is authorized for commercial sand and gravel extraction and commercial mussel harvest. A sweep of the area revealed that mussel density is lower than that in the originally proposed dredge area; thus, there is a lower probability of federally listed mussel species inhabiting that site. The disposal site was selected for the same reasons. The proposed dredge and disposal sites are each less than one-half acre in size.

Divers, using timed searches, will examine the dredge and disposal areas before dredging begins to collect qualitative and quantitative samples. The sample sites will be marked utilizing GPS, and all live mussels collected in the samples will be counted and identified. Ten quantitative samples, using a one-quarter square meter quadrat, will be collected from a minimum of three sites. Substrate removed from each quadrat will be brought to the surface and washed through a series of sieves. All live mussels found in quadrat samples will be identified, measured, and returned to the river in approximately the location from which they were removed.

Two treatments will be used for the experiment. One treatment will simulate existing dredging operations. Full scoops of substrate will be removed with the clamshell. The barge will be loaded to its full capacity of 300 cubic yards, and the dredged material will be dumped at an in-river disposal site by slowly opening the barge while backing away perpendicularly from the riverbank. In the second experimental treatment, the clamshell will remove only the top 12 inches of substrate and the barge will be loaded with only 15 cubic yards of material (i.e., five percent of full capacity). While in transport to the disposal site, the substrate (and mussels) in the barge will be sprayed with water to keep it moist. At the disposal site, the towboat will move slowly over the area and dump the contents of the barge onto the river bottom in a manner that will spread the material in a thin layer. During dredging, one or more buckets of material will be placed on a flat barge; biologists will remove and measure mussels found, and determine mortality to mussels by examining the shells for cracks, scrapes, or other dredge-caused damage. Separate disposal sites will be used for each barge load of material; each site will be located with GPS and marked with buoys in the water and flagging on the riverbank.

Divers will collect mussels from each disposal site as soon as such collection is deemed safe. Live mussels will be counted, identified, measured, marked with an identifying number, and returned to the disposal site from which they were collected. All recently dead and damaged mussels will be retrieved and a mortality estimate made. Follow-up sampling will be conducted one month and 12 to 14 months post-disposal to determine mortality to the relocated mussels. As a control, mussels will be collected from an undisturbed area, marked, and monitored at the same intervals.

After dredging has been completed, divers will conduct timed searches to examine dredged areas to assess efficiency of removal of mussels with the dredge. Approximately five to ten quantitative samples, using a one-quarter square meter quadrat, will be collected from the dredged area to check for additional mussels. An estimate will be made of the percentage of mussels that can reasonably be expected to be removed prior to actual dredging operations. Service biologists will be notified of the time and date that the experiment will take place. Progress reports will be prepared and submitted within 30 days of each field trip; and a final report summarizing all data collected will be prepared. Copies of all reports will be sent to appropriate Federal and State agencies for review.

● Background Information

The Tennessee River Basin contains one of the richest and most diverse freshwater mussel faunas in the world, including many species endemic to the Cumberland Plateau Region. Because of its age and the fact that it did not undergo glaciation, the Tennessee River basin has long been known as a primary center of mussel speciation. Over 100 species historically occurred and evolved in the Tennessee River and its tributaries. Since 1900, however, populations of many species have undergone significant declines, some to the verge of extinction and others reduced to remnants restricted to isolated portions of their former ranges. Several species in the genus Epioblasma have not been recorded from any stream in the entire Tennessee or Cumberland River drainages for over 50 years and are presently believed to be extinct. At present, more than 60 species may still inhabit streams and rivers in the basin, 27 of which are officially listed as endangered species. Although some species occur in the main stem of the Tennessee River, many are found in the tributaries and others are limited in range to the medium-sized and small headwater streams.

Some mussel species can be found in slow-flowing, mud-bottomed pool habitats, but the majority prefer shoal or riffle areas with relatively swift current over substrate consisting of mixed cobble, gravel, and sand. The current maintains a high dissolved oxygen content and sweeps the bottom clean of silt and other settleable materials. Freshwater mussels are sedentary; unless they are dislodged or their habitat is de-watered, they probably remain in one place for life. Feeding is accomplished by filtering detritus, plankton, and diatoms from the water column.

Gametogenesis in most species of freshwater mussels follows one of two annual cycles. Fertilization and development occurs in early spring in tachytictic (short-term) breeders. Glochidia are released in late spring through late summer. Fully developed glochidia are retained in the female's brood pouches over winter in bradytictic (long-term) breeders, and released the following spring.

Reproduction among mussels is unique. Sperm produced by the males are released into the water column. These drifting sperm are siphoned from the water by females during normal respiration and feeding activity. Fertilized eggs are stored in specially modified gills that act as brood pouches for the developing larvae, or glochidia. Fully developed glochidia are released into the water and drift with the current. Within three or four days, they must attach to a suitable fish host, encysting on gill filaments, opercles, or fins. Varying levels of host specificity have been reported for a number of mussel species. Those glochidia not successfully attaching to a host fish probably settle to the bottom eventually and perish or serve as prey for fish or invertebrate predators. During the period of attachment to the host, which lasts up to several weeks depending on water temperatures and other factors, the glochidia metamorphose. Although they do not undergo significant growth, glochidia are thought to derive some nutrition from the host. When metamorphosis is complete, the glochidia detach from their host and, again drifting with the current, settle to the stream bottom as fully developed juvenile mussels. It is thought that there are two stages in this cycle that are critical: attachment to the host and settling to the bottom after detachment. Significant mortality likely occurs at both stages as a result of glochidia attaching to unsuitable hosts or not successfully attaching, and from juveniles settling into unsuitable habitat.

A number of factors have been identified as causes in the decline of freshwater mussel populations in the Tennessee River Basin. Construction of impoundments converted miles of free-flowing riverine habitat to more lake-like conditions. Alteration of water temperature, reduction in flow, change in fish communities, and accumulation of sediment on reservoir bottoms eliminated significant populations of riffle-dwelling mussels. Suitable habitat for these species now exists only in the river reaches below the dams, and in un-impounded streams and rivers in the headwater areas. However, coldwater releases from some of the dams have rendered some tailwaters uninhabitable by mussels. Although species of mussels that are tolerant of lentic conditions still exist in the upper reaches of some reservoirs, these communities are neither as abundant nor diverse as those existing prior to impoundment.

Siltation is another cause in the decline of mussel species in the Tennessee River. Mussels naturally occurred in and adapted to conditions in streams that were subjected to periodic siltation from annual flooding cycles. However, silt loads resulting from construction, logging, agricultural activities, dredging, mining, and development are likely to be more prolonged and excessive than those from seasonal storm events. Some mussels have been found to react to suspended sediment by cessation of siphoning activity. This results in significant stress resulting from reduction in respiration and feeding. Adult, juvenile, and larval mussels may also be smothered by silt blanketing the stream bottom. Heavy silt may also smother eggs and fry of fish that serve as hosts, or cause adult fish to abandon a river reach.

Because of their sedentary nature and filter-feeding habits, mussels are particularly susceptible to pollution. Pollutants such as pesticides and metals are siphoned from the water and may result in direct mortality, or accumulate in the body tissues and be passed up the food chain. Because they accumulate pollutants, mussels are considered to be excellent indicators of water quality.

Over the past ten to fifteen years, a series of significant mussel die-offs have been reported throughout the United States east of the Mississippi River. Causes are unknown, but mortality rates of up to 95 percent have been estimated for the mussel communities affected. From 1983 to 1985, a mussel die-off was observed by biologists and commercial mussel divers below Pickwick Dam. Both commercially important and endangered species were observed dead and dying on the river bottom. If this phenomenon continues, further reductions in numbers and range for many mussel species may result.

In the early 1900's, freshwater mussels were commercially harvested for shells to be used in the manufacture of pearl buttons. Only the shells of certain species provided acceptable shell material, but indiscriminate harvest caused significant declines in many mussel stocks. Subsequent development of plastics reduced demand for shell buttons and resulted in reduction of commercial mussel harvest. However, shells of freshwater mussels are presently in demand for use in the cultured pearl industry. Although pressure is not as great as in the past and States that allow mussel harvest regulate the fishery through limitations on issuance of licenses and establishment of legal size restrictions, harvest of mussels puts added stress on already stressed populations, including

populations of endangered species. Most listed species are not commercially valuable, but they are occasionally taken during harvest of other species. Continued incidental harvest of these rare species could result in extirpation of populations, or threaten the species' continued existence.

To date, there appears to be a lack of information regarding success of mussel transplants, particularly information about whether or not transplanted individuals survive and reproduce (Dunn 1991). Several transplant studies (Steve Ahlstedt; Richard Neves, personal communications) have reported positive results, but both reported relatively high levels of mortality at some transplant sites, and neither provided conclusive proof that mussel transplants do not adversely affect the individuals or the populations. To determine success apparently requires long-term monitoring, which most agencies are unable or unwilling to do. If relocated mussels exhibit low survival and little or no reproduction, then transplants may actually cause adverse effects, not avoid them. Therefore, it appears that, until research provides evidence that transplants of endangered mussels can and do succeed, protection of occupied habitat, even marginal habitat, may be the only means of avoiding adverse project impacts or jeopardy to the continued existence of endangered mussels. The proposed experiment addresses this research need.

White wartyback pearly mussel

The white wartyback pearly mussel, *Plethobasus cicatricosus*, was listed as an endangered species on June 14, 1976 (USFWS 1999). It is an Ohioan (Interior Basin) species occurring in the Ohio, Cumberland, and Tennessee River systems. Historical records indicate that the species occurred in the Tennessee River, Cumberland River, Ohio River, Holston River, Wabash River, and Kanawha River (Parmalee and Bogan 1998; USFWS 1984). It has always been uncommon throughout its range, and the only recent collections of this species have been from the mainstem of the Tennessee River. Since young specimens have been found recently only in the Tennessee River below Wilson Dam (Alabama), the species may be facing imminent extinction. The white wartyback is a big-river species, inhabiting shoal and riffle areas with sand and gravel substrate. Its life history is unknown, but it may be a short-term breeder as is its congener *P. cyphyus*. Fish hosts for the species are also not known (Parmalee and Bogan 1998; USFWS 1984).

The action area is within the known range of the white wartyback. Live individuals have been collected recently from the Tennessee River below Wilson Dam in Alabama and below Pickwick Dam in Tennessee.

Orange-foot pimpleback

The orange-foot pimpleback, *Plethobasus cooperianus*, was listed as an endangered species on June 14, 1976 (USFWS 1999). It is also an Ohioan species, but it is more widely distributed than *P. cicatricosus* (Parmalee and Bogan 1998; USFWS 1984a). Historically, the orange-foot pimpleback occurred in the Ohio, Kanawha, Wabash, Rough, Tennessee, Duck, French Broad, Holston, Clinch,

and Cumberland Rivers. It was reported to be an abundant species in the Ohio, Wabash, and Cumberland Rivers; however, it was rare in the Tennessee River and its tributaries above Knoxville. Presently, *P. cooperianus* is known to occur in the Tennessee River for an undetermined number of miles below Pickwick Dam (Tennessee); the Cumberland River at Bartlett's Bar and Rome Landing (Tennessee); and the lower Ohio River near Metropolis and Olmstead, Illinois, and McCracken County, Kentucky. Of these three populations, only the one in the Tennessee River is known to be reproducing. (Parmalee and Bogan 1998; USFWS 1984a) The orange-foot pimpleback is also a large-river, shoal species. It is found in gravel and sand in water from 15 to 29 feet in depth. The species' life history is unknown, but gravid females have been collected during the summer, indicating that the species is a short-term breeder. The glochidia are undescribed and the fish hosts are unknown. (Parmalee and Bogan 1998; USFWS 1984a)

The range of the orange-foot pimpleback includes the action area. Live individuals have been collected recently upriver below Pickwick Dam, in the vicinity of Diamond Island, adjacent to Shiloh National Military Park, and downriver to the headwaters of Kentucky Lake.

Rough pigtoe mussel

The rough pigtoe mussel, *Pleurobema plenum*, was listed as endangered on June 14, 1976 (USFWS 1999). It is an Ohioan species that was historically widespread in the Ohio River, Cumberland River, and Tennessee River systems, and it was reported to occur in large rivers in Arkansas and southwest Kansas (Parmalee and Bogan 1998; USFWS 1984b). The rough pigtoe presently occurs only in the Tennessee River, Cumberland River, Clinch River, Green River, and Barren River. In the Tennessee River, the species is thought to occur for an undetermined number of miles below Pickwick, Wilson, and Guntersville Dams (Alabama), and is believed to be reproducing below Pickwick. It is also thought to be reproducing in the Green River (Kentucky) and upper Clinch River (Virginia) (Parmalee and Bogan 1998; USFWS 1984b). *P. plenum* is considered rare in the Cumberland River. Sampling by TVA in 1976 failed to find any live specimens in the Cumberland. Surveys done in the Green and Barren Rivers indicate that the rough pigtoe occurs in the Green River from lock and dam 5 (Glenmore, Kentucky) to lock and dam 4 (Woodbury, Kentucky), and in the Barren River from the mouth to lock and dam 1. Since this population is considered to be abundant, reproduction and recruitment are likely occurring. The species' life history is not known, but studies done on other *Pleurobema* species indicate that *P. plenum* is a short-term breeder. Fish hosts are unknown. (Parmalee and Bogan 1998; USFWS 1984b)

The action area is within the known range of the rough pigtoe. Recent collections of this species have not been made from below Pickwick Dam, but historic records are available (Bogan and Parmalee 1983).

Ring pink

The ring pink (formerly known as the golf stick pearly mussel), *Obovaria retusa*, was listed as an endangered species on September 29, 1989 (USFWS 1999). It is also an Ohioan species. Historically, it was a wide-ranging species, occurring in the Ohio, Cumberland, and Tennessee River systems in Pennsylvania, West Virginia, Ohio, Illinois, Indiana, Kentucky, Tennessee, and Alabama. It is presently found in only four river reaches: the Tennessee River in Livingston, Marshall, and McCracken Counties, Kentucky; the Tennessee River in Hardin County, Tennessee; the Cumberland River in Wilson, Trousdale, and Smith Counties, Tennessee; and the Green River in Edmonson and Hart Counties, Kentucky (Parmalee and Bogan 1998; USFWS 1991). No recent evidence of reproduction or recruitment has been reported for any of the four populations, and the continued existence of all of the populations is questionable. The ring pink is a shoal species, inhabiting riffle areas with sand and gravel substrate. The species' fish hosts and life history are unknown. (Parmalee and Bogan 1998; USFWS 1991)

The known range of the ring pink includes the Tennessee River in the action area. Although it was thought to have been extirpated, fresh-dead shells were found below Pickwick Dam, and live specimens have been collected from the Tennessee River below Kentucky Dam within the past 15 years (Bogan and Parmalee 1983).

Cracking pearly mussel

The cracking pearly mussel, *Hemistena* [= *Lastena*] *lata*, was listed as endangered on September 28, 1989 (USFWS 1999). It is an Ohioan species that historically occurred in the Ohio River from Ohio to Illinois; the White, Wabash, and Tippecanoe Rivers in Illinois and Indiana; the Cumberland, Green, Kentucky, and Big South Fork Rivers in Kentucky; the Tennessee, Cumberland, Powell, Clinch, Holston, Elk, Duck, and Buffalo Rivers in Tennessee; the Tennessee River in Alabama; and the Powell, Clinch, and Holston Rivers in Virginia. However, it currently exists in only three river reaches: the Clinch River in Hancock County, Tennessee, and Scott County, Virginia; the Powell River in Hancock County, Tennessee and Lee County, Virginia; and the Elk River in Lincoln County, Tennessee. Although the species has not been reported from the Green River since 1966 and the Tennessee River below Pickwick Dam since the mid-1970's, small populations are thought to still occur in those rivers. The cracking pearly mussel inhabits riffle and shoal areas in medium-sized streams having gravel or mixed gravel/sand substrate. Reproductive characteristics and fish hosts for this species are also unknown. (Parmalee and Bogan 1998; USFWS 1991a, 1992)

The known range of the cracking pearly mussel includes the action area. Although the species has not been collected recently from the action area, it may still persist in low densities.

Fanshell

The fanshell, *Cyprogenia stegaria*, was listed as an endangered species on June 21, 1990 (USFWS 1999). It is another Ohioan species that was described as being a medium to large river mussel. Historically, it had a wide distribution in the Ohio, Wabash, Cumberland, and Tennessee drainages in Pennsylvania, Ohio, West Virginia, Illinois, Indiana, Kentucky, Tennessee, Alabama, and Virginia. However, over the past ninety years the species has undergone significant population declines throughout its range. Presently, reproducing populations are thought to occur only in the Clinch River, Hancock County, Tennessee and Scott County, Virginia; the Green River, Hart and Edmonson Counties, Kentucky; and the Licking River, Kenton, Campbell, and Pendleton Counties, Kentucky. Nonreproducing, remnant populations still exist in Tygarts Creek, Greenup and Carter Counties, Kentucky; the Cumberland River, Smith County, Tennessee; and the Tennessee River, Rhea, Meigs, and Hardin Counties, Tennessee; as well as the Muskingum River in Ohio, Wabash River in Illinois and Indiana, the East Fork White and Tippecanoe Rivers in Indiana, and the Kanawha River in West Virginia. Like the other species addressed in this opinion, the fanshell is an inhabitant of riffles and shoals in the mainstem of the large rivers and their larger tributaries and, like the others, many aspects of its life history are unknown. (Parmalee and Bogan 1998; USFWS 1991b, 1992)

The action area is within the known range of the fanshell. Although no recent records for this species are available from the action area, the species was collected historically from that reach of the Tennessee River.

Pink mucket pearly mussel

The pink mucket pearly mussel, *Lampsilis abrupta*, was listed as an endangered species on June 14, 1976 (U.S. Fish and Wildlife Service 1999). It is an Ohioan species with a relatively wide range. Historical records indicate that this species once occurred in large rivers in Alabama, Arkansas, Illinois, Indiana, Iowa, Kentucky, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. Presently, known populations occur only in the Big River, Black River, Clinch River, Cumberland River, Current River, Gasconade River, Green River, Kanawha River, Little Black River, Meramec River, Ohio River, Osage River, Paint Rock River, and Tennessee River (U.S. Fish and Wildlife Service 1985, 1992; Parmalee and Bogan 1998). Of these extant populations, only four (i.e., Cumberland River, Meramec River, Paint Rock River, and Tennessee River) have shown recent evidence of reproduction. Some taxonomists have recently postulated that the reproducing populations west of the Mississippi River are not *Lampsilis abrupta*, but rather are sub-species of another endangered species—i.e., *Lampsilis higginsii*. If this is true, then only three known reproducing populations of *L. abrupta* are extant. Although it has a relatively wide distribution and is apparently more tolerant of lentic habitat conditions than other listed mussel species, the pink mucket pearly mussel is reported to be rare where it occurs.

This species inhabits primarily shoal areas in large rivers with swift currents, depths of 0.5 to 8.0 meters (1.6 feet to 26.2 feet), and mixed sand/gravel/cobble substrate. Notwithstanding this, the pink mucket pearly mussel appears to have adapted to lentic conditions in the upper reaches of some impoundments. Life history aspects of this species are presently unknown, although it may be a long-term breeder, as are other *Lampsilis* species. The glochidia are undescribed and the fish host is unknown (U.S. Fish and Wildlife Service 1985, 1992; Parmalee and Bogan 1998).

The proposed project is within the range of the pink mucket pearly mussel. A live individual was collected from the area proposed as the experimental dredging site during an evaluation of potential dredging and disposal sites.

- Environmental Baseline

The Tennessee River in the action area has been subjected to numerous anthropogenic impacts. Construction of Pickwick Dam, approximately 12 miles upriver, created an impoundment that likely has affected natural downriver flows. The river is heavily used by navigation traffic; a minimum depth navigation channel is maintained in this un-impounded reach. Periodic dredging has been needed to maintain the channel and to remove rock outcroppings that extend into the channel. Sand and gravel dredged from the channel are disposed of in the back chute of Diamond Island, approximately one mile to the south. Additionally, commercial sand and gravel dredging operations have occurred downriver at Wolf Island and, to a limited degree, upriver in the vicinity of Diamond Island.

The area through which the action area flows is primarily rural and agricultural land. Cleared areas have likely contributed sediment to the river and affected the aquatic fauna. However, no urban, industrial, or residential developments exist along this reach of the river. Pickwick Lake likely acts as a catchment for discharges from the urban areas of Florence, Sheffield, and Muscle Shoals, Alabama; and the nearest urban area, Savannah, Tennessee, lies approximately five miles downriver. The action area is, therefore, somewhat protected from pollutants discharged from urban areas.

- Direct/Indirect Effects

Effects to listed species resulting from the proposed action will be limited to the one-half acre dredging and disposal sites. Direct mortality to individual mussels could occur from crushing, cracking, or other damage to the shell as the dredge scoops up substrate. Mussels suffering immediately non-lethal damage to the shells would be indirectly affected; adverse effects could occur subsequent to dredging.

Indirect effects also could occur at the disposal site. Mussels will be dumped from the barge with the dredged substrate. It will take an undetermined amount of time for each mussel to reposition itself in the substrate, and some may be unable to do so, perishing by suffocation.. River currents could move some of these relocated mussels downriver into areas of unsuitable habitat.

Indirect effects to mussels could also result from handling. Mussels collected for data recording will be out of the water for some time while data are collected. This will cause stress to individual mussels that may or may not result in more serious effects or mortality at a later time.

- Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The area in which the proposed action will be conducted is not currently being affected by development. Boat and barge traffic move upriver and downriver, but there are no major urban areas in the vicinity of the proposed mussel removal and relocation experiment. We do not expect that there are any State, local, or private actions that are reasonably certain to occur in the action area in the foreseeable future. Therefore, cumulative effects, as defined by the Endangered Species Act, are not anticipated to occur.

- Conclusion

After reviewing the current status of the pink mucket pearly mussel, orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, and rough pigtoe; the environmental baseline for the action area; the effects of the proposed experiment; and the cumulative effects; it is our biological opinion that the evaluation of an alternative method for removal and relocation of freshwater mussels prior to dredging operations is not likely to jeopardize the continued existence of the pink mucket pearly mussel, orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, and rough pigtoe. In addition, the proposed experiment is not likely to destroy or adversely modify designated critical habitat. No critical habitat has been designated for these species, therefore, none will be affected.

INCIDENTAL TAKE

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental

take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of the incidental take statement contained in the biological opinion issued for the action.

The measures describe below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Corps of Engineers has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps of Engineers (1) fails to adhere to the terms and conditions of the incidental take statement and/or (2) fails to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

- Amount or Extent of Incidental Take

We anticipate that the amount of incidental take of the pink mucket pearly mussel, orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, and rough pigtoe will be difficult to estimate for the following reasons: 1) no mussel population or density estimates are currently available for the areas to be dredged for the proposed experiment; 2) the dredge site has been selected specifically because it is located in a disturbed river reach that is authorized for commercial sand and gravel dredging, commercial mussel harvest, and because federally listed mussel species likely occur there at extremely low densities. However, mussels that are actually dredged will be brought to the surface and examined for evidence of injury or mortality. Live individuals will be marked after they are deposited on the disposal site and subsequently monitored to estimate mortality. A single live pink mucket pearly mussel was collected from the proposed dredge site during a qualitative mussel survey; this individual was relocated out of the dredge site. Although the potential for any of the federally listed mussel species addressed in this biological opinion to occur in the proposed dredge area is low, we anticipate that one individual of each species may exist there and could possibly be incidentally taken during implementation of the proposed experiment.

- Effect of the Take

In the accompanying biological opinion, we determined that this level of take is not likely to result in jeopardy to the pink mucket pearly mussel, orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, or rough pigtoe, or result in the destruction or adverse modification of critical habitat.

- Reasonable and Prudent Measures

We believe that the following reasonable and prudent measure is necessary and appropriate to minimize incidental take of the pink mucket pearly mussel, orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, and rough pigtoe:

1. The proposed experiment will be conducted such that stress to mussels will be minimized.

- Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps of Engineers must comply with the following term and condition, which implement the reasonable and prudent measure described above. This term and condition is non-discretionary:

1. Mussels brought to the surface for data collection will be handled only as much as is needed to mark the individuals and collect the necessary data. Individuals from which data have been collected will be held in mesh bags in the river while awaiting replacement. All live mussels will be returned to the river as soon as possible after collection.

Upon locating a dead, injured, or sick specimen of an endangered or threatened species, initial notification must be made to the nearest Fish and Wildlife Service Law Enforcement Office (Mr. Steve Middleton, 150 Trademark Business Center, 220 Great Circle Road, Nashville, Tennessee 37228; telephone 615/736-5532). Care should be taken in handling sick or injured specimens to ensure effective treatment and care, and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

The reasonable and prudent measure, with its implementing term and condition, is designed to minimize incidental take that might otherwise result from the proposed action. With implementation of this measure, we believe that one individual each of the orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, and rough pigtoe) will be incidentally taken. Because it has a higher likelihood of inhabiting the action area, we believe that no more than five pink mucket pearly mussels will be incidentally taken. If, during the course of the action, incidental take of more than one individual of the orange-foot pimpleback, white wartyback, fanshell, ring pink, cracking pearly mussel, or rough pigtoe; or incidental take of more than five pink mucket pearly mussels occurs, such incidental take represents new information requiring review of the reasonable and prudent measures provided. The Corps of Engineers must immediately provide an explanation of the causes of the taking and review with Service biologists the need for possible modification of the reasonable and prudent measures, or reinitiation of consultation.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We believe that this provision of the ESA places an obligation on all Federal agencies to implement positive programs to benefit listed species, and a number of recent court cases appear to support that belief. Agencies have some discretion in choosing conservation programs, but section 7(a)(1) places a mandate on agencies to implement some type of program.

We offer the following conservation recommendations for consideration:

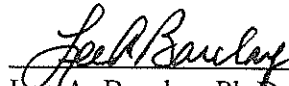
1. The Corps of Engineers should implement a long-term study of the effects of dredging on freshwater mussels. Experiments such as the one addressed in this biological opinion should be conducted, but long-term monitoring (i.e., minimum of four years) should be done to determine if relocated mussels survive for more than one year and reproduce. Studies should also be done to determine how long it takes mussels to re-orient themselves in the substrate after being removed, and what types of events would move them into unsuitable habitat before that time elapses.
2. The Corps of Engineers should seek opportunities to assist, and take an active role, in efforts to propagate and reintroduce freshwater mussels within their historic ranges. Efforts to reverse the effects of adverse impacts to riverine habitats and to restore those habitats are succeeding in some areas. It is unlikely that mussels will re-colonize those areas naturally; therefore, reintroduction of adult mussels and propagated juveniles of species that historically occurred in those river reaches is probably the only way to restore those populations.

In order for us to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

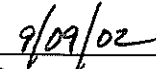
REINITIATION - CLOSING STATEMENT

This concludes consultation on the action outlined in the consultation request. As provided in 50 CFR Sec. 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take specified in this biological opinion is exceeded, (2) new

information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion, (3) the agency action is subsequently modified to include activities that cause an effect to the listed species or critical habitat not considered in this biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation of consultation.



Lee A. Barclay, Ph.D., Field Supervisor



Date

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